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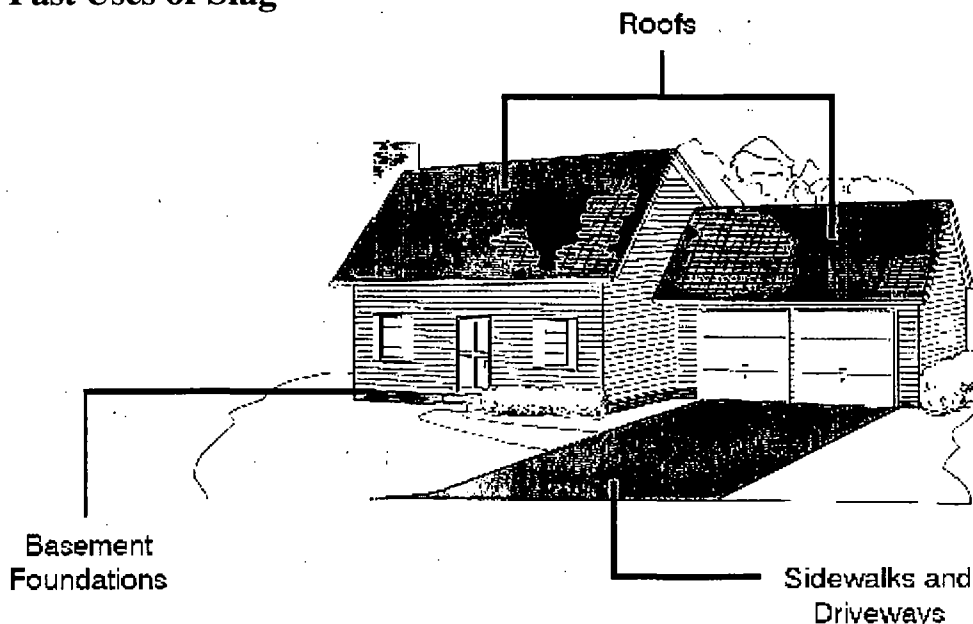
How to Find Out if You Have a Problem with Radiation from Slag

Residents throughout Southeast Idaho are invited to participate in a voluntary program conducted jointly by the District Health Department, FMC, Monsanto, and EPA. The program helps residents find out if phosphorus slag in their homes and business properties is causing unacceptably high exposure to radiation. The voluntary program is designed to determine if phosphorus slag has been used in your home or business property as well as measure the radiation dose of individuals living and working in buildings where phosphorus slag is found. Participation in the program is free, and it takes very little of your time.

When elemental phosphorus is produced, it is removed from a mixture of phosphate ore, silica, and coke. The largest remaining by-product is a lava-like rock known as "slag." Primarily a compound of calcium and silica, slag also contains small quantities of uranium and radium. These two elements are naturally present in the phosphate ore. Their presence in the slag causes it to emit very low levels of gamma radiation - a type of radiation similar to medical x-rays.

Slag has historically been used extensively in Southeast Idaho for construction purposes as aggregate in concrete and asphalt, roadbed fill, backfill, and railroad ballast. In the 1950s, '60s, and early '70s, it was also used in the concrete poured for some basements and building foundations.

Past Uses of Slag

[Questions & Answers](#)

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Q: If I participate in the program, what will the results tell me?

A: The results will tell you whether you are being exposed to elevated radiation levels.

Q: How much does it cost to participate in the program?

A: There is no cost for participating.

Q: Where in Southeast Idaho is the program being conducted?

A: The focus of the study is in the communities of Pocatello and Soda Springs. Individuals in surrounding communities are welcome to participate in the program, however.

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Unit: Brownfields/Site Cleanup Unit 1

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Last Updated: 07/18/2002

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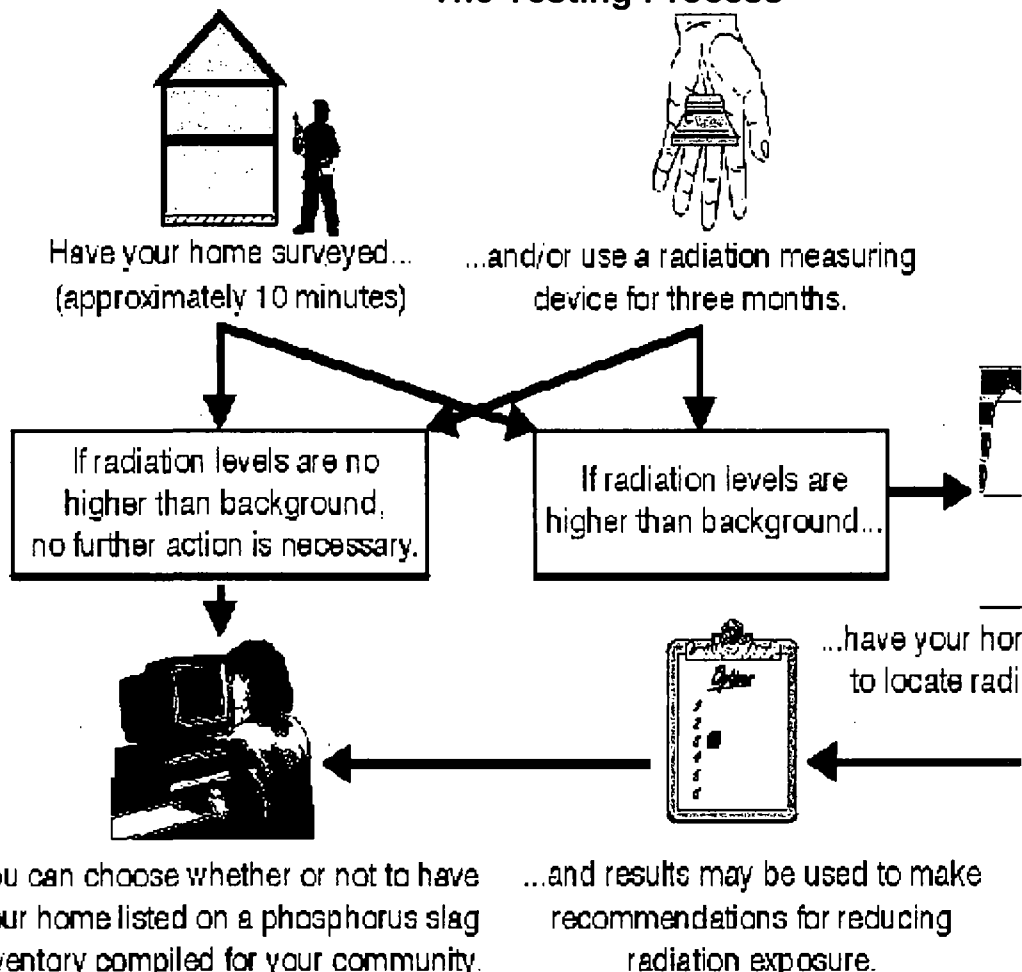
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How to Sign Up to Participate in the Slag Prog

Homeowners and other building owners who wish to participate in the voluntary exposure Southeast Idaho District Health Department either at (208) 233-9080 in Pocatello or (208) Springs.

There are two ways to participate in the program. One involves a survey of your home or b The other involves wearing a thermoluminescent dosimeter, or TLD. People who want to k if there are elevated radiation levels in their buildings may wish to participate in the buildin who want to know how much radiation they are being exposed to might prefer to wear a T

The Testing Process



Things To Keep In Mind

1. Participation in the program is voluntary.

- 2. You may select the way you participate in the program.
- 3. Recommendations for reducing your radiation exposure may be based on the survey and will be provided to you.
- 4. You may choose whether or not to list your building's results on the phosphorus slide.

Questions & Answers

Q: What happens if either I don't want to participate in the program or I only partially participate?

A: Nothing. The testing process is entirely voluntary, and an individual can decide not to participate at any time.

Q: Can I have my business property surveyed?

A: Yes. Any building in Southeast Idaho can be included in the program.

Q: How should I decide whether to have my building surveyed or to use a TLD?

A: That choice is entirely up to you. Some people prefer the idea of a home survey because it is completed in a few minutes. Others prefer to know how much radiation they are being exposed to by wearing the TLD for three months. And you don't necessarily have to choose. You can participate in the program both ways.

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More Information About the Surveys and the Thermoluminescent Dosimeters

Surveys are performed with instruments that measure radiation and identify specific locations in the buildings where radiation exceeds natural background levels. Surveys measure radiation dose rates (for example, dose per hour) and in most cases can tell you whether your building has radiation levels above background, indicating that slag may be present.

The survey team will make an appointment with you, and you must be present to have the survey conducted. Once you have given your permission to the team to enter your building, team members will check for radiation levels that are higher than would be expected for Southeast Idaho. Measurements will be taken on the main floor and in the basement. The team will spend only a few minutes in your building. If the measurements do not show significant levels of radiation in your building, you will be given a statement of the team's findings. If elevated radiation levels are found, the team will inform you that the measurements indicate you may have slag in your building and recommend more extensive measurements.

Thermoluminescent Dosimeters are small devices that measure radiation dose over time. Normally, TLDs are used for a period of three months and then processed to determine the total dose accumulated during the period of exposure.

To find out how much radiation you are being exposed to, you can sign up to use a thermoluminescent dosimeter, or TLD. A TLD is an instrument that measures how much radiation a person is being exposed to. You can make an appointment to pick up a TLD by calling the District Health Department in Pocatello or Soda Springs. During your appointment, you will be given a demonstration for proper use of the TLD. TLDs are small enough to be used on a key ring, which is how it is recommended you use it.

In order to obtain a measurement that reflects your living habits, a TLD should be used for a period of three months. That means that you need to carry it with you, or have it near you, at all times. For example, you could place it on a bedside table at night while you sleep. After three months, you should bring the TLD back to the District Health Department, which will have it processed and provide you with your results within three weeks.

Comparison of Surveys and Thermoluminescent Dosimeters

Surveys	TLDs
Surveys measure the rate of radiation dose in a specific location	TLDs measure radiation dose for a specific individual or a specific location within a building over time
Surveys provide immediate results.	TLDs must be used over a period of three months.
Homeowners must provide access to indoor house locations, and the method is somewhat intrusive for study participants.	While TLDs are less intrusive, individuals wearing TLDs must keep the dosimeter on or near them over the required three-month time period.

Questions & Answers

Q: I wear a TLD at work because I am exposed to radiation as part of my job. Should I wear the TLD for the phosphorus slag program to work as well?

A: Yes. This program is designed to assess total exposure to radiation, including radiation doses received at work and doses received at home. Subtracting the radiation dose you receive at work from the total dose measured by the TLD will help determine how much radiation you are being exposed to at home. If you were to leave the TLD at home, it would tell you only what radiation dose you would receive if you stayed at home all the time.

Q: Should everyone in our family get their own TLD?

A: That's really up to you. It does require some effort to keep track of the TLD for three months. What you might consider is having the person who spends the most time at home wear the TLD. If the results indicate elevated radiation exposures, other family members can always decide to wear a TLD later.

Q: What if the building survey or TLD indicates exposure rates that are higher than expected?

A: If the initial building survey or TLD indicates that you may be exposed to elevated radiation levels, more extensive measurements will be recommended. These measurements will help you find out exactly where in your building you are being exposed to radiation. participate in the more extensive dose rate measurements, you need to make an appointment by calling the District Health Department.

First, the building owner must grant permission to the team members to enter the building and perform detailed measurements. Then, they will visually inspect the building to look for physical evidence of slag. Next, they will measure the radiation dose rate in every room in the building using a meter that measures radiation levels. Finally, they will provide detailed time logs to be used in calculating each individual's radiation dose.

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What is the Phosphorus Slag Technical Work Group?

In 1992, FMC, Monsanto, and the U.S. EPA joined together to form the Phosphorus Slag Technical Work Group. The Technical Work Group was convened to develop guidelines to help individuals interpret radiation exposure results from the phosphorus slag program and determine what, if any, action should be taken to reduce their exposure.

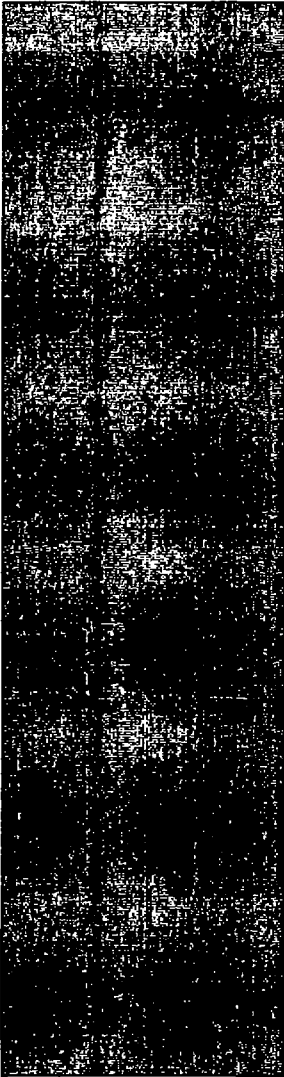
The Technical Work Group is composed of two Monsanto and FMC representatives; two EPA representatives; two company-selected and two EPA-selected radiation experts; and one representative each from the City of Pocatello, the City of Soda Springs, the State of Idaho, and the Shoshone-Bannock Tribes.

Technical Work Group Members

<p>Bill Adams United States Environmental Protection Agency Seattle, Washington</p> <p>Peter J. Angstadt Mayor Pocatello, Idaho</p> <p>John Auxier Auxier Associates Knoxville, Tennessee</p> <p>Paul Chapp Centers for Disease Control, Agency for Toxic Substances and Disease Registry Atlanta, Georgia</p> <p>Farshid Farsi Shoshone-Bannock Tribes Fort Hall, Idaho</p> <p>Thomas Gesell Idaho State University Pocatello, Idaho</p> <p>Gary Gier Soda Springs, Idaho</p>	<p>Kent Lott Monsanto Company Soda Springs, Idaho</p> <p>Mark Masarik United States Environmental Protection Agency Boise, Idaho</p> <p>Pat McGavran Idaho Department of Health and Welfare Boise, Idaho</p> <p>Bill Moore FMC Corporation Pocatello, Idaho</p> <p>Richard Poeton United States Environmental Protection Agency Seattle, Washington</p> <p>Facilitator: Dr. Bernard Graham Wilkes University College of Pharmacy Wilkes-Barre, Pennsylvania</p>
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The Technical Work Group's Guidelines

The Phosphorus Slag Technical Work Group has developed a set of guidelines to help residents make decisions based on the results of the program. The Technical Work Group's recommendations include a range of things that can



be done to reduce residents' exposure to radiation from slag. They include: attrition, or removing the slag once the structure's useful life has ended; alterations in how the occupants use the area; and building additional living space to replace areas that contribute to elevated radiation doses. After you get your results, the District Health Department will provide you with information, including the Technical Work Group's guidelines. What you do to reduce your exposure to radiation, if anything, will be entirely up to you.

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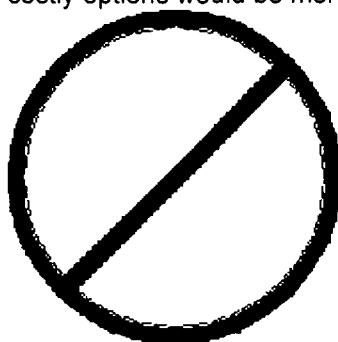
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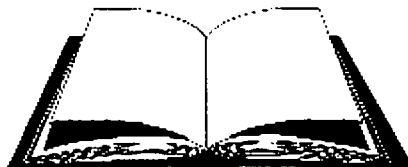
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Concerned Citizens**What if Your Building Has Slag in It?**

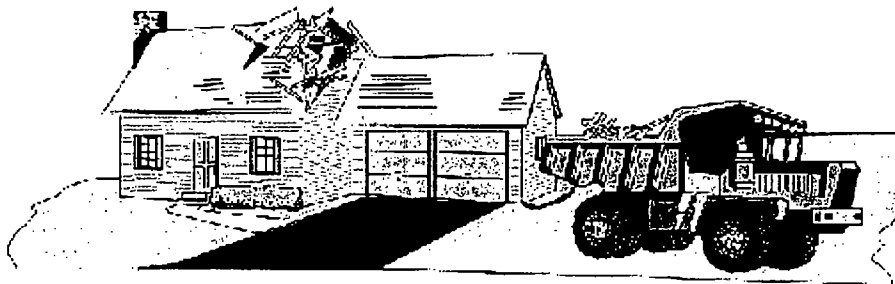
The Phosphorus Slag Technical Work Group recommends the following action options for reducing individual radiation dose. The options start with the easiest and least expensive and range up to the most difficult and costly. It is the TWG's view that simpler and easier options are more appropriate for lower doses while more costly options would be more appropriate at higher doses.

**No Action**

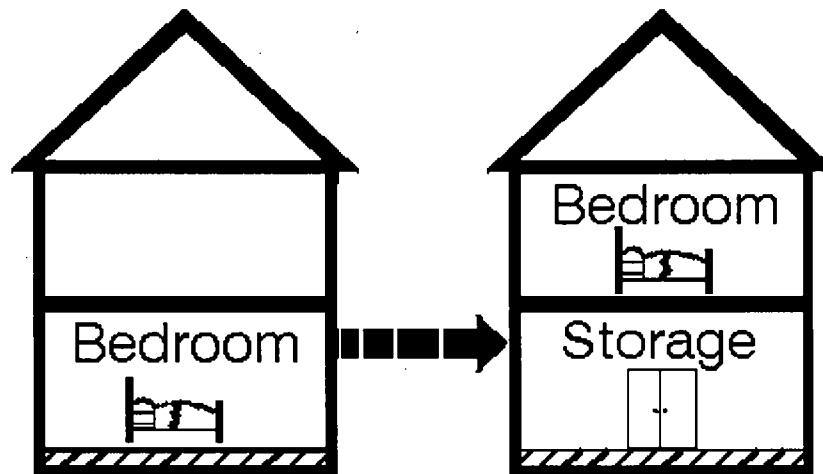
Scientific opinion differs about how much low-level radiation an individual can be exposed to without harm. The possibility exists that there may be a threshold level of radiation exposure below which there are no adverse health effects. Consequently, exposure to natural background radiation levels may not pose any health risks. However, current evidence suggests that exposure to radiation at very low levels may pose some risk of cancer.

**Education and Counseling**

Education and counseling would include a balanced discussion of radiation risk and radiation protection measures. This would include exploring the range of possible actions that could be taken to reduce an individual's dose, such as possible changes in use patterns - like spending less time in the basement.

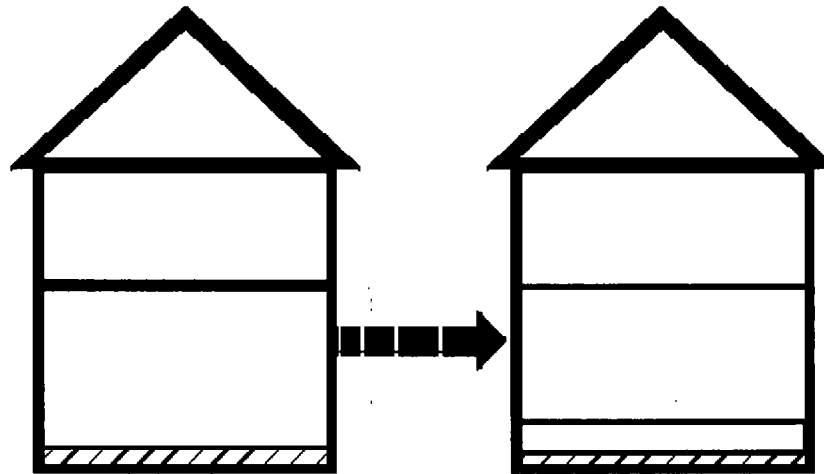
**Attrition**

Attrition means removing slag once a structure's useful life has ended. This would involve listing the building on the phosphorus slag inventory and subsequent removal of the slag to an appropriate disposal location when the building is demolished.



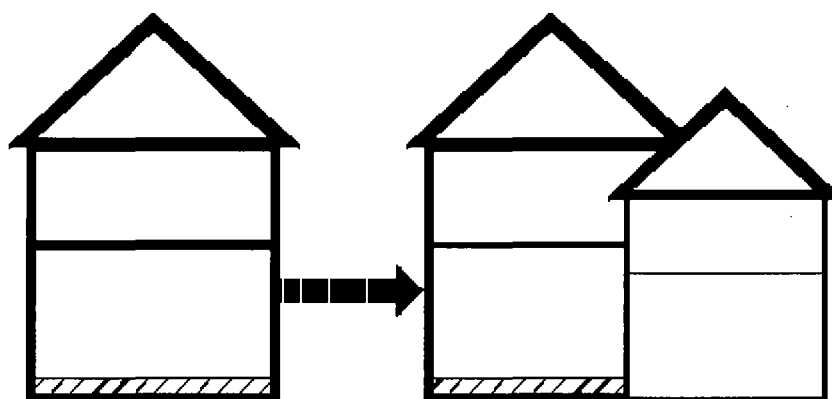
Modification of Use

Space that contributes to radiation dose would be converted to an alternative use in order to reduce the amount of time that individuals spend in a space where slag significantly contributes to individual dose.



Remodeling, Shielding, or Partial Removal

This option involves reducing exposure through physical changes to the building either through removal or shielding of the slag areas.



Additional Living Space

This option would provide additional living space to replace areas that contribute to an elevated dose. For example, a new bedroom could be built onto a home to replace a basement bedroom.

The TWG anticipates that cost-effective risk reduction options will be considered on a case-by-case basis, and each homeowner will have an opportunity to discuss any specific concerns with a radiation risk professional.

TWG Recommended Actions	Dose above background				Dose, including background
	Less Than 100 mrem	More Than 100 mrem	More Than 200 mrem	More Than 300 mrem	More Than 500 mrem
Do Nothing	X				
Education and Counseling		X	X	X	X
Attition		X	X	X	X
Modification of Use			X	X	X
Remodeling, Shielding, or Partial Removal				X	X
Additional Living Space					X

Questions & Answers

Q: How will it be determined that something must be done to reduce my exposure to gamma radiation?

A: If the more extensive measurements indicate that slag is present in your building, the District Health Department will present you with a copy of the Technical Work Group's recommendations for reducing your exposure to the slag. But you will make the decision about whether anything will be done, and if so, what will be done. No one will force you to do anything you don't want to do.

Q: What if I do want to reduce my exposure according to the Technical Work Group's guidelines? Some of the options look costly. Who will pay for that?

A: FMC and Monsanto have agreed to pay.

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Considerations for Building Owners

No one else will be given your testing results. The results of the testing will be maintained confidentially by the testing contractor working for the District Health Department, Monsanto, and FMC. Testing results will be reported to EPA and the public in aggregate only (no names and addresses will be used). For example, we might occasionally provide statistics on how many properties have been tested and what the range of results is.

The Phosphorus Slag Inventory

The District Health Department, Monsanto, and FMC have established an "inventory" of phosphorus slag testing results for Southeast Idaho. The inventory is a listing of the most recent testing results. All residential entries in the inventory have been approved by their owners.

The inventory lists public places (including streets, sidewalks, businesses and public buildings) that have been found to contain phosphorus slag, even though such places may not contribute a significant level of exposure to radiation for most people. The primary reason for automatically listing public places in the inventory is to ensure that the slag will be adequately considered when the areas are replaced due to normal wear and tear.

What About Radon?

Residents in Southeast Idaho may experience elevated radiation doses in their homes and business properties from many sources. The primary focus of the phosphorus slag program is on gamma radiation from phosphorus slag that has been used as a building material in many area buildings. Some buildings may have elevated radon levels which increase radiation dose to the occupants. Radon is an invisible, odorless gas and a natural part of the environment. It will be important to know the level of radiation resulting from radon in addition to that resulting from phosphorus slag so that appropriate measures can be taken to protect the residents' health. Because of this, property owners participating in the program may also have their buildings surveyed for radon.

Questions & Answers

Q: Who else will be given the results of the survey of my property?

A: No one. Program results will be reported in aggregate only. For example, we might provide statistics on how many properties have been evaluated and what the overall results have been.

Q: My home was built in 1988. Should I still participate in the program?

A: While buildings built in the 1980s and 90s are less likely to have phosphorus slag in them than homes built in the 1950s, 60s, and 70s, we can't guarantee that they do not. If you want to know for sure whether or not your

building has slag in it, you are welcome to participate in the program.

Q: How long will the testing program be offered?

A: EPA, FMC, and Monsanto have agreed to conduct an initial phase of testing in 1996 and 1997. After this initial period, the testing will be available for an indefinite period of time for those individuals that would like to participate. The extended offer will be particularly useful to either new residents or individuals that would like to have a residence retested after making changes to reduce exposure.

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Recommendations for People Who are Buying or Selling a Building

EPA's Recommendations for People Who Are Buying a Building:

1. Contact the District Health Department to determine if the building is listed on the Southeast Idaho Phosphorus Slag Inventory.

2. If the building is not listed on the inventory, you may want to ask the building owner to have it tested. Find out the results.

3. If the test results of a building you purchase indicate the potential for elevated radiation exposure due to the presence of phosphorus slag, take action to reduce that exposure. Consult the Technical Work Group's recommendations and have the building retested.

EPA's Recommendations for People Who Are Selling a Building:

1. If you haven't already done so, sign up to participate in the program. Find out if phosphorus slag in your building is causing elevated radiation levels.

2. If testing results indicate the potential for exposure to elevated radiation levels as a result of phosphorus slag, take action to reduce that exposure according to the Technical Work Group's recommendations.

3. After taking action to reduce radiation exposure, have the building retested to find out if the action was effective. Have the District Health Department update the information in the Southeast Idaho Phosphorus Slag Inventory.



Questions & Answers

Q: Will this program affect my property

values?

A: If you have your property tested and (1) no elevated radiation levels are found or (2) elevated radiation levels are reduced by implementing one of the Technical Work Group's recommended action options, then prospective buyers can be reassured. Such reassurance should enhance your property's value as compared to other properties that have not been tested.

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What is Radiation?

Some atoms, known as "radionuclides", are unstable--or radioactive. Radionuclides undergo a spontaneous decay process and emit one or more types of radiation until they reach a stable form. There are three main types of radiation: alpha radiation; beta radiation; and gamma radiation, which is very similar to x-rays. This program is limited to gamma radiation that is emitted by phosphorus slag. Gamma radiation consists of electromagnetic waves, which can penetrate skin and travel through the human body.

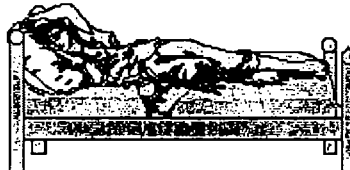
Naturally occurring radioactive materials in the earth--primarily uranium, thorium, radium, radon, and potassium--and cosmic rays from outer space immerse us in fluctuating amounts of radiation at all times. Background radiation varies by location and results from a combination of cosmic radiation and naturally occurring radiation in the earth. The phosphorus slag program looks for building where radiation levels exceed the expected background level.

In addition to naturally occurring sources of radiation, people are exposed to manufactured sources of radiation as well, including medical applications, consumer goods, and the operation of the nuclear power industry. Medical doctors use man-made radiation for diagnosis and treatment of cancer and other diseases.

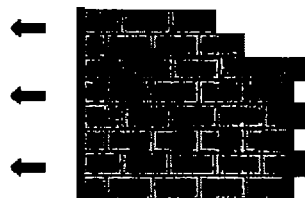
Of the total amount of radiation that the average person in the United States is exposed to in a year, 82% comes from natural sources and 18% from nonnatural sources. Medical diagnosis and therapy account for more than 90% of the

FACTORS THAT AFFECT YOUR RADIATION EXPOSURE

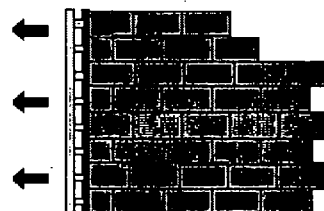
- How long and how often you are exposed

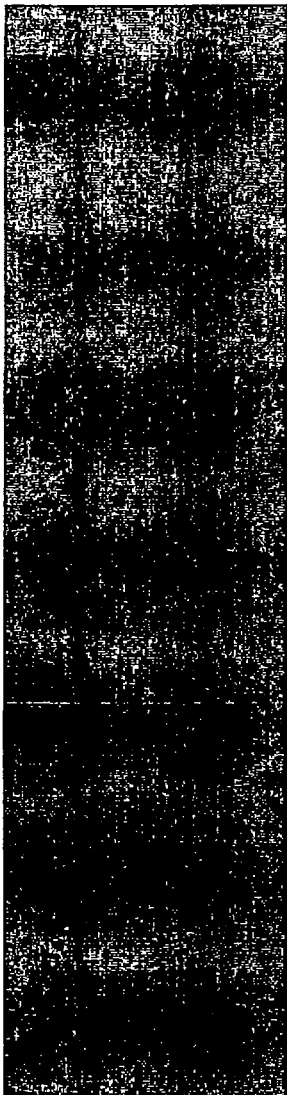


- How far away you are from the source



- How much shielding or absorbing material is present





dose from nonnatural sources.
Despite the benefits of radiation in
our modern world, increases in
exposure to radiation have been
linked to increases in cancer rates.
For that reason, the phosphorus
slag program seeks to reduce
exposure to radiation for residents of
Southeast Idaho.

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How does Radiation Affect Human Health?

High doses of radiation can be harmful or even fatal. The damage caused by exposure to radiation is determined by the type of radiation, the duration of exposure, and the part of the body that is exposed. The effects of a radiation dose are either prompt or delayed. Prompt effects occur within the first several months after exposure. Delayed effects occur over many years. The delayed effects can include cancer or other diseases in exposed persons and harmful effects on unborn children.

It is important to note that an average of one in four people develops some form of cancer. Excess lifetime cancer risks resulting from exposure to radiation are calculated in addition to this number. Risk estimates assume that even small amounts of radiation pose some risk.

The total number of observed cancers in Southeast Idaho is low by national standards. Healthy lifestyles, rural living, and a low incidence of smoking and drinking likely contribute to the lower overall incidence of cancer in this area. Despite low cancer rates in the region, however, EPA remains concerned about possible increases in cancer risk that may be associated with slag. For that reason, EPA, Monsanto, and FMC are hopeful that area residents will participate in the phosphorus slag program.

Questions & Answers

Q: What level of radiation is safe?

A: No one knows for sure. This question is of on going interest to scientists and researchers.

Q: How is radiation dose measured?

A: Radiation dose is the amount of radiation that is absorbed by the body. The human body's absorption of ionizing radiation is measured in units called "rems". Low levels of radiation are measured in thousandths of a rem, or "millirems".

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Unit: *Brownfields/Site Cleanup Unit 1*
Point of contact: *Bill Adams*
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Last Updated: 07/18/2002

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Concerned Citizens**September 1995 Fact Sheet on SE Idaho Phosphorus Slag****Public Comment Invited**

The U.S. Environmental Protection Agency (EPA) would appreciate your comments on two documents related to potential public health impacts of radiation exposure to phosphorus slag in southeast Idaho. EPA is accepting comments over a 30 day period from September 18 to October 17, 1995.

The first document is the "Exposure Study Workplan." This workplan identifies the equipment and techniques that will be used during a program for southeast Idaho residents to voluntarily participate in a study of individual exposure to radiation from slag.

The second document contains recommendations from the Phosphorus Slag Technical Work Group for "Graded Decision Guidelines" designed to assist individuals in interpreting results from the exposure study.

These documents are summarized in this fact sheet. We recommend that you read the two documents to gain a better understanding of the upcoming radiation exposure measurement program. These documents are available in the following area libraries:

Pocatello Public Library
113 South Garfield
Pocatello, ID 83204
(208)232-1263

Soda Springs Public Library
149 South Main
Soda Springs, ID 83276
(208)547-2606

Idaho State University Library
Government Documents Department
9th and Terry
Pocatello, ID 83209
(208)236-2940

Shoshone-Bannock Library
Pima and Bannock
Fort Hall, ID 83203
(208)238-3700 ext. 3882

Portneuf District Library
5210 Stuart Street
Chubbuck, ID 83202
(208)237-2192

Written comments should be mailed to: Bill Adams, Project Manager, U.S. Environmental Protection Agency, 1200 Sixth Avenue, M/S HW-113, Seattle, WA 98101 Phone: (206) 553-2806 or 1-800-424-4EPA, Fax: (206) 553-0124

Monsanto, FMC, and EPA will be hosting three open houses during the comment period to help provide the information you will need to comment. Come anytime during the open houses to ask questions and provide your comments. Representatives from Monsanto, FMC, EPA, and the Technical Work Group will be available to talk with you. Please attend one or more of the following:

Pocatello
Tuesday September 26th
Idaho State University Student Union Building
Salmon River Suites, 4th floor
Session 1: 2:00 - 4:00pm
Session 2: 7:00 - 9:00pm

Fort Hall Indian Reservation
Wednesday September 27th
Tribal Council Chambers
Agency Road and Bannock Drive
5:00 - 7:00pm

Soda Springs
Thursday September 28th
Caribou County Courthouse 159 South Main
Session 1: 3:00 - 5:00pm
Session 2: 7:00 - 9:00pm

EPA will consider your comments as the two documents are finalized to ensure that the program meets the needs of the both the agency and residents of southeast Idaho.

Background

The Idaho Radionuclide Study

In May 1990, the EPA issued a report on the Idaho Radionuclide Study. The study concluded that some citizens in Pocatello and Soda Springs could be at increased risk of contracting cancer because of long-term exposure to low-level radiation from slag in building foundations, streets, and sidewalks.

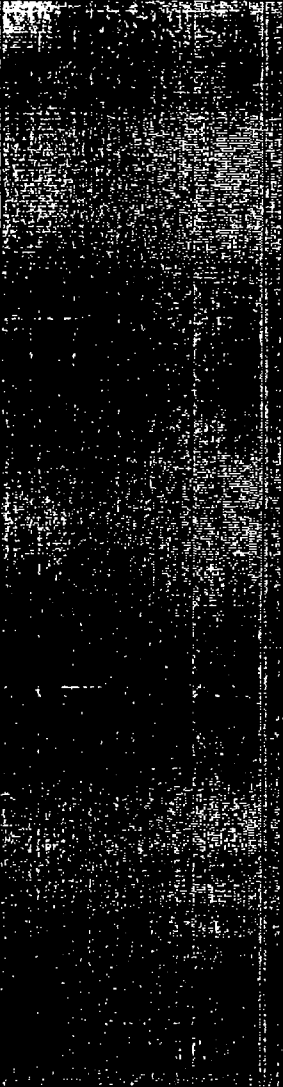
The slag is a byproduct of the elemental phosphorus industry. An EPA Science Advisory Board (SAB) reviewed the study and provided recommendations for further action that included additional testing of actual radiation exposures to individuals and the development of "graded decision guidelines" to help the public interpret testing results.

Slag in Buildings

Slag has historically been used extensively in Southeast Idaho for construction purposes as aggregate in concrete and asphalt, roadbed fill, backfill, and railroad ballast. In the 1950s, 60s, and early 70s, it was also used in the concrete poured for some basements and building foundations. Limited surveys have been conducted in Pocatello and Soda Springs to identify slag in structures. These surveys positively identified slag in several hundred homes in Soda Springs and found elevated levels of radiation in both communities.

The Technical Work Group

Monsanto and FMC (historical producers of phosphorous slag in Southeast Idaho) recognize the importance of close cooperation with EPA and the communities to successfully implement the SAB's recommendations. The Phosphorous Slag



Technical Work Group (TWG) was established to address complex technical and socioeconomic issues associated with the studies and the graded decision guidelines. The TWG is composed of two Monsanto and FMC representatives; two EPA representatives; two company-selected and two EPA-selected radiation experts; and one representative each from the city of Pocatello, the city of Soda Springs, the State of Idaho, and the Shoshone-Bannock Tribes.

Exposure Study Workplan

The purpose of the voluntary exposure study is to assess individual radiation dose (dose is the amount of radiation absorbed by the body), identify sources of radiation exposure, and to locate phosphorous slag in the communities. The individual dose results can be used in combination with the Graded Decision Guidelines to help individuals decide what, if any, action should be taken to reduce radiation exposure from slag.

The Exposure Study Workplan is a product of IT Corporation, a contractor working for Monsanto and FMC. This document has been developed, in cooperation with and with the approval of EPA, to measure individual radiation exposure to phosphorous slag.

The proposed exposure study begins with an initial screening conducted with survey instruments to determine if there are elevated levels of radiation in the building. The second step, if requested by the resident, is a more detailed evaluation using Thermoluminescent Dosimeters (TLDs) and/or other survey instruments which will provide information on individual radiation exposure. The second step is recommended if initial results are significantly above background, or the homeowner has reason to believe there is slag in or around the home.

Specific details on who to contact to participate in the study, when, and what risk reduction options will be available will be announced in a second fact sheet released after the public comment period. The second fact sheet will also announce the approval of the radiation exposure study workplan and outline the EPA's final Graded Decision Guidelines.

Definitions

Surveys are performed with instruments that measure radiation directly and can identify specific locations in the home where radiation levels are highest. During the survey, you will be able to directly observe radiation levels in your home and around your property. Surveys measure the rate of radiation dose (for example, dose per hour) and in most cases can tell you whether your home has radiation levels above background, indicating that slag may be present in your home. However, without extensive time spent measuring and modeling at various locations, survey instruments cannot measure an individual's dose.

Background radiation varies by location and is a combination of cosmic radiation from space and radiation from naturally occurring uranium, thorium, radium, radon, and potassium in the earth. The average background level for Soda Springs and Pocatello is approximately 13 microrentgen per hour (R/hr) or 105 mrem/year.

TLDs are small devices that measure radiation dose over time. They can be worn to measure radiation dose to a person wherever they go, or they can be fixed in a place to measure the radiation dose at the location for a period of time. Normally, TLDs are used for a period of three months and then processed to determine the total dose accumulated during the period of exposure. TLDs are worn routinely by radiation workers and medical personnel to monitor their exposure. Use of TLDs alone will not tell you whether your home has radiation levels above background indicating slag may be present in your home. TLDs could help in determining whether you are currently receiving radiation in excess of background.

Graded Decision Guidelines (What do the Results Mean)

The EPA SAB is an independent group of scientists who act as consultants to the EPA Administrator. In 1992, the SAB reviewed the Idaho Radionuclide Study and recommended that EPA establish a set of "Graded Decision Guidelines" to help individuals interpret radiation exposure study results and determine if any action should be taken to reduce exposure. The TWG assisted EPA in this task by preparing a set of recommendations for the guidelines based upon a variety of technical and economic factors.

What follows is a summary of the TWG recommendations for evaluating exposure results. Although EPA participated in the TWG, its recommendations do not represent the agency's final policy. However, public comments on this preliminary proposal by the TWG will be helpful in forming an EPA position, recognizing that the task of issuing a final set of Graded Decision Guidelines rests with EPA. We encourage you to review the entire document created by the TWG in order to help you make specific comments. Appendix A includes a perspective on the different radiation doses in excess of natural background radiation as compared to various standards, risk, and exposure to phosphorous slag. The TWG recommendations are based on three levels of exposure from phosphorus slag. These levels are based on established national and international guidelines.

For individual doses which exceed 500 millirems per year, including natural background levels, it is recommended that actions be taken to reduce radiation doses. (The human body's absorption of ionizing radiation is measured in units called "rems." Low levels of exposure are measured in thousandths of a rem, or "millirems" which is abbreviated mrem.)

For individual **doses less than 100 mrem per year above background levels**, no further action is recommended.

For individual **dose between 100 mrem per year above background levels, and 500 mrem per year including natural background levels**, it is recommended that actions be considered to reduce exposure.

The TWG's recommendations do not address, and were not intended to address, the following two issues. EPA believes that these issues are best resolved at the national level.

1. Differences of opinion regarding the health effects of exposure to low levels of radiation.

Scientific opinion differs about how much low-level radiation an individual can be exposed to without harm. The possibility exists that there may be a threshold level of radiation exposure, below which there are no adverse health effects. Consequently, exposure to natural background levels may not pose any health risks. However, current evidence suggests that exposure to radiation at very low doses poses some risk of cancer. Rather than resolve this question, the TWG proceeded as recommended by the National Academy of Sciences, the National Council on Radiation Protection, and other international scientific bodies. Based on the assumption that the risk of cancer increases as exposure to radiation increases, the TWG recommended that any action taken to reduce exposure should result in more good than harm.

2. Decisions regarding continued or future use of phosphorus slag

To date, the EPA has not restricted use of phosphorus slag through any regulatory program. FMC and Monsanto have voluntarily stopped sales of slag.

EPA endorses this voluntary halt until the issue of future use of phosphorus slag can be resolved at the national level. Various private industries, companies, and local governments have continued to use slag from stockpiles for a variety of purposes. EPA discourages continued use of this material.

If phosphorous slag was used in the construction of your home, you may be exposed to more radiation than you would otherwise receive. Factors that affect the dose that a person receives include: how long and how often a person is exposed, how far away the person is from the source of radiation, and how much shielding or absorbing material there is between the person and the source of radiation.

The TWG developed additional guidance, which incorporates consideration of cost and feasibility, to aid individuals in reducing risk for various levels of exposure above 100 mrem per year. (While many scientific bodies believe that doses below 100 mrem per year pose some risk, they are not easily measured due to limitations in measurement techniques and the presence of naturally occurring background radiation). The options listed start with the easiest and

least expensive and range up to the most difficult and costly. It is the TWG's view that simpler and easier options are more appropriate for lower doses (near 100 mrem above background), while more costly options would be more appropriate at higher doses.

The TWG stated that these options are intended only as guidance and are likely to be appropriate in many cases. The recommendations are not intended to prevent consideration or selection of options other than those which are listed with a particular dose level. EPA, FMC, and Monsanto will be negotiating a voluntary agreement which will make assistance available to homeowners who wish to take actions recommended by the Graded Decision Guidelines. Because EPA and the companies have agreed to base this agreement under the Resource, Conservation, and Recovery Act, EPA does not have the authority or funds to support recommended actions. (In 1990, EPA committed to resolving this issue outside the Superfund remedial process in response to community concerns.)

The TWG anticipates that cost-effective risk reduction options will be considered on a case-by-case basis and each homeowner will have an opportunity to discuss any specific concerns with a radiation risk professional.

Options to Reduce Exposure

Dose:

More than 100 mrem per year above background levels (Background radiation levels for southeast Idaho are an average of 105 mrem/yr of exposure from naturally occurring radiation, not including radon.)

Recommended Option:

Education/Counseling/Attrition

After participation in the exposure study, individuals would receive information on how to reduce risk by changing patterns of use in a home. For example, spending less time in a basement containing slag could significantly reduce total exposure.

Attrition involves removing slag in the future when the building is replaced. This would involve listing of the building on an inventory and removing of the slag to an appropriate disposal location. This option will not reduce current annual radiation doses for those unable to modify home use.

Dose:

More than 200 mrem per year above background levels

Recommended Option:

Modification of Use

Space that contributes to radiation dose would be actively converted to an alternative use. For example, a basement bedroom would be converted to a use in which individuals spend less time in the room. This option would reduce

exposures for current residents, provided they can abide by the changes. This option would also provide long-term effectiveness if future occupants adopted the modified use. This option does not reduce either total slag radiation in the building or potential risks if the modified use not be continued.

Dose:

More than 300 mrem per year above background levels

Recommended Option:

Remodeling/Shielding/Partial Removal

This option involves reducing exposure through physical changes to the building either through removal or shielding of the slag areas. This option would permanently reduce exposures to current and future residents of a building, and would reduce the total radiation exposure to people from slag in the building.

Dose:

More than 500 mrem per year including background levels

Recommended Option:

Additional Living Space

This option would provide additional living space to replace areas that contribute to an elevated dose. For example, building a new bedroom or other home addition to replace a basement bedroom would reduce current dose. Future exposure would also be reduced if new residents adopted the modified use of the building (i.e., not using the basement). This option does not reduce the total radiation exposure from slag in the building.

What About Radon?

The members of the TWG believe that risk from radon, although not associated with phosphorous slag, should be taken into consideration by homeowners when evaluating overall risk from radiation and risk reduction strategies. Accordingly, the proposed exposure study workplan includes free home testing for radon so that homeowners can factor the results into decisions on reducing overall radiation risks.

Radon can be found in all areas of the U.S. Occurrence is typically higher in areas with naturally occurring uranium in soil, such as in the Western U.S. Of the 50 homes previously evaluated in southeast Idaho, 14 exceeded EPA recommendations.

Radon is an invisible, odorless gas and a natural part of the environment--not manmade. Slag does not release significant quantities of radon. The costs to reduce radon in a home are generally low, and radon remediation is often effective in reducing risks from radiation. EPA has a national program to reduce public exposure to radon and recommends that all individuals test their homes and take action if levels associated with an average excess lifetime cancer risk of approximately 1.3 in 100 are found. Radon remediation involves such things as sealing basement cracks, ventilating spaces with high radon levels, and installing subslab ventilation. A typical radon problem can be solved for \$1,000 to \$1,500.

Appendix A: Radiation Dose Comparison

All people continually receive radiation from a variety of sources. Some of these sources are naturally occurring, such as cosmic radiation, and some sources are manmade, such as medical X-rays. A perspective on different radiation doses that an individual could receive above natural background radiation levels compared to various standards and recommendations, is illustrated in Figure 1.

The following radiation doses should be considered in southeast Idaho:

- 52 millirem: Hypothetical average yearly dose from slag in Soda Springs according to EPA's Idaho Radionuclide Study (excess lifetime risk of cancer - approximately 1 in 1,000).
- 100 millirem: Approximate yearly dose from external exposure to natural background radiation in Pocatello and Soda Springs (excess lifetime risk of cancer - 3 in 1,000).
- 205 millirem: Hypothetical maximum yearly dose from slag in Soda Springs according to EPA's Idaho Radionuclide Study (excess lifetime risk of cancer - approximately 6 in 1,000).

It is important to note that an average of 1 in 4 people develops some form of cancer. Excess lifetime cancer risks resulting from exposure to radiation are calculated in addition to this number. For radiation protection purposes, risk estimates assume that even small amounts of radiation pose some risk. At exposures comparable to external background radiation, however, the possibility that there may be no risks cannot be ruled out.

The total number of observed cancers in Southeast Idaho is low by national standards. Healthy lifestyles, rural living, and a low incidence of smoking and drinking likely contribute to the lower overall incidence of cancer in this area. Despite low cancer rates in the region, however, EPA remains concerned about possible increases in cancer risk that may be associated with slag. As in similar communities, like those close to uranium mines, EPA recommends action when risks are increased by at least one in 10,000 over existing cancer risks. For that reason, EPA is hopeful that area residents will participate in the voluntary exposure study.

Comparing these risk levels is very difficult because people perceive risks differently, depending on the nature of the risk and their individual experiences. For example, some people judge the riskiness of a hazard based solely on the likelihood of its having adverse effects, while others are concerned mainly about the hazard's potential effects, regardless of the likelihood; who the hazard affects; and how widespread, familiar, and dreaded the effects are. People's perception of risk is influenced also by whether they think they have a choice and control over the situation (i.e., risks may appear riskier if people have not voluntarily agreed to bear them or if they have no control over the source and management of the risks). People's perceptions of risk also are influenced by the benefits derived from accepting the risks, and

by the fairness, equity, and the distribution of risks and benefits.

As an example, many people oppose nuclear power plants, because they dread the potential destructive effects from accidental release of large amounts of radiation to the environment; the technology is unfamiliar; and they feel like they have no control over the plants' operation. However, these same people may engage in statistically more risky but voluntary activities, such as smoking, mountain climbing, or driving a car. Other people may be less concerned about nuclear power because they perceive that the likelihood of a catastrophe is very low, compared to being involved in an automobile accident, for example. Many people also perceive that manmade hazards are far more risky than natural hazards.

Additional examples of radiation exposure standards and recommendations can be found in the TWG recommendations.

Figure 1

Examples of Radiation Exposures, Standards, and Recommendations

We Need Your Comments

EXAMPLES OF RADIATION EXPOSURES, STANDARDS, AND RECOMMENDATIONS

EPA welcomes any comments on the exposure study workplan. However, we would also appreciate your responses to and comments on the following questions:

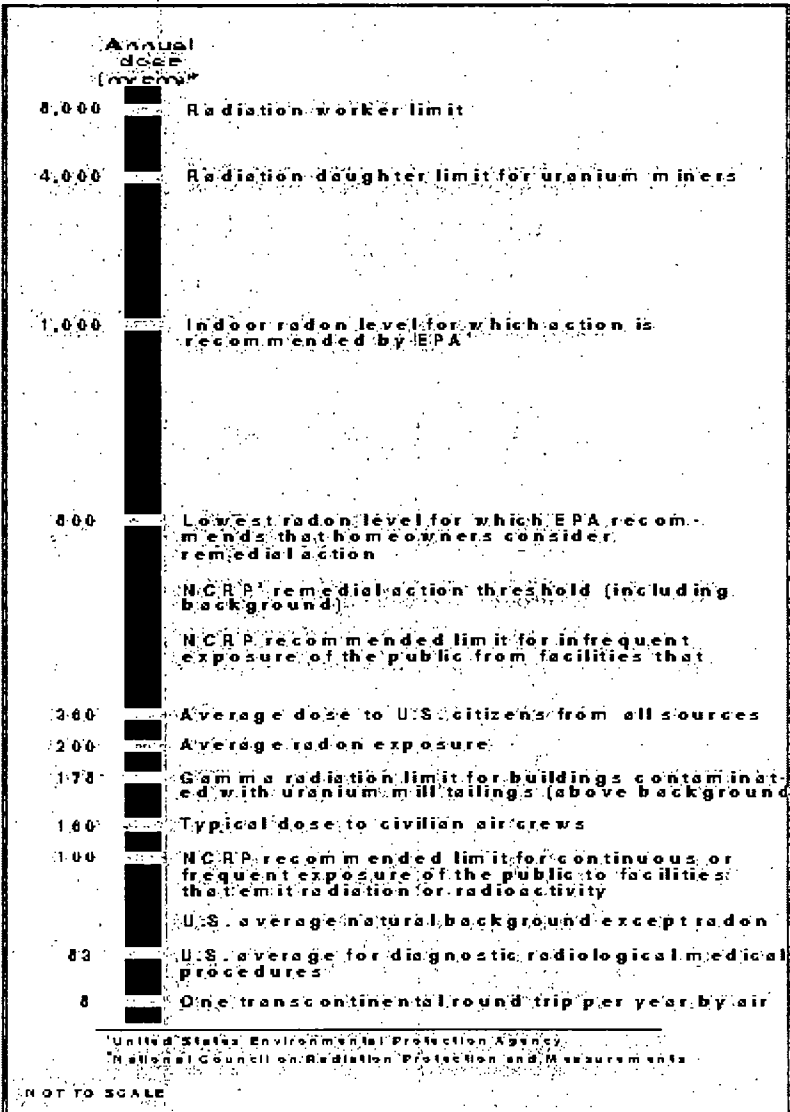
1.If you were to fully participate in the exposure study, you would learn the following about your home:
Presence of slag

Maximum possible exposure

Current exposures

Radon level

Is there any other information that you would like to see provided during or after the exposure study?
2.Should testing of homes be offered for a



...for a
specific period of
time or
indefinitely?

3. Do you have
any particular
concerns or
comments
related to the
testing such as
confidentiality,
scheduling of
testing, home
access, etc.

4. EPA would like your input on the development of an inventory of buildings containing slag.

The SAB recommended that EPA record the location of slag to assure that the radioactivity due to slag content is considered in disposing of the materials when these areas are eventually replaced due to normal attrition. This clearly makes sense for public areas such as streets and sidewalks where there appears to be no immediate concern. The proposed exposure study will provide this kind of information on community areas. However, development and maintenance of an inventory for buildings with slag presents a dilemma for the agency for the following reasons:

- On the one hand, an inventory for buildings is necessary for the purpose the SAB recommended: to ensure that radioactivity due to slag is considered in disposing of the materials when these areas are eventually replaced. In addition, unless testing of homes is offered over an indefinite time period, the inventory could also be important during real estate transactions, should homeowners decide to include the results about their building in the inventory.
- On the other hand, such use of an inventory might discourage some individuals from participating in the exposure study for fear the results could reduce their property value.

5. EPA would like your comments on whether future residents should be informed about slag radiation and, if so, how?

6. EPA would like your comments on the proposed approach to reduce risk from slag.

The options recommended by the TWG offer guidance in reducing radiation exposure. However, only Option 4, Remodeling/Shielding/Partial Removal, would permanently reduce exposure to radiation from slag in a building. Options 1 through 3 are not permanent and depend on some modification in use of the building through changes in lifestyle. The success of such an approach is largely dependent on a current or future homeowners ability to accommodate the necessary use changes on a permanent basis. While these guidelines are not intended to prevent selection and consideration of options other than those listed, it is uncertain whether funds will be available to take action outside these guidelines.

For More Information:

If you have any questions about the contents of this fact sheet, please contact one of the following:

Bill Adams, EPA Site Manager, at (206) 553-2806

Misha Vakoc, EPA Community Relations Coordinator, at (206) 553-8578

Tom Gesell, Technical Work Group Spokesperson, at (208) 236-3669

Trent Clark, Monsanto, at (208) 547-4300 (ext. 348)

Mike Smith, FMC, at (208) 343-4100

For those with impaired hearing or speech, please contact EPA's telecommunication device for the deaf TDD) at (206) 553-1698.

To ensure effective communication with everyone, additional services can be made available to persons with disabilities by contacting one of the EPA staff above.

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Index A - ZAir Quality
Superfund
Waste and Chemicals
Water QualityInnovative Solutions
Business & Industry
Concerned Citizens**May 1996 Fact Sheet on SE Idaho
Phosphorus Slag**

The U.S. Environmental Protection Agency (EPA), FMC, and Monsanto are pleased to announce a new program in Southeast Idaho to assist individuals in determining their level of exposure to radiation from phosphorus slag. EPA is also distributing the "Graded Decision Guidelines," developed by the Technical Work Group, for use by program participants in evaluating program results. This fact sheet outlines the program and describes the Graded Decision Guidelines.

Exposure Study Testing Program Begins

With the distribution of the Graded Decision Guidelines, EPA believes that all recommendations of the Science Advisory Board have been met and the exposure study should now proceed. The program will begin in June of 1996. This voluntary program will include surveys of public areas, screening of individual homes and business properties, and measurement of individual radiation exposures for those participating in the program.

How do I participate? Homeowners and other property owners who wish to participate in the voluntary exposure study can either call the Phosphorus Slag Information Line (toll-free) at 1-888-905-8800 or return the form on page 7. The information line is answered by Southeastern District Health Department personnel, who can provide information on phosphorus slag, health risks associated with radiation, and options for reducing your exposure to radiation.

If you prefer, you can complete and return the Participation Form (on page 7 of this fact sheet). You will be contacted by the District Health Department to arrange an appointment.

If you have already indicated your desire to participate in the program, you will receive a notification letter shortly.

What is involved in the testing? A technician will make an appointment to visit your home with a small radiation survey instrument. The initial home screening takes approximately 20 minutes. If the levels of radiation are below 20 microrems per hour (approximately equivalent to 100 millirems per year), no further evaluation of your home will be necessary. (The human body's absorption of ionizing radiation is measured in units called "rems." Low levels of exposure are measured in thousandths of a rem - millirems or in millionths of a rem - microrems.)

If levels are above 20 rems per hour, EPA recommends that the homeowner elect to participate in a more detailed home survey and/or wear a thermoluminescent dosimeter (TLD) to determine his/her exposure. Arrangements for further evaluation can be discussed during the initial screening.

Some individuals may prefer to wear a TLD before having their home surveyed. Individuals who wish to participate that way need only make their preferences known when signing up to participate.

Who will be given my testing results? No one. The results of the testing will be maintained confidentially by the testing contractor working for the Companies and the District Health Department. Testing results will be reported to EPA and the public in aggregate only (no names and addresses will be used). For example, we might occasionally provide statistics on how many properties have been tested and what the range of results were.

Will this program affect my property value? It shouldn't, given the confidential nature of this program which guarantees that others will not know your test results unless you choose to disclose them. It is currently unclear as to whether slag must be reported under the Idaho Disclosure Law.

Whether you suspect that slag is in your home or not, your test results may be useful information to provide to prospective home buyers. If your home is found to be free of slag, you may want to share that information. Alternatively, if slag is found in your home and test results indicate that actions should be considered to reduce your exposure to radiation, then you will have an opportunity to reduce your exposure based on the Graded Decision Guidelines. Any actions taken to reduce exposure could be useful information to prospective buyers. In some situations, such actions may enhance the value of your property as compared to other homes where action to reduce exposure was warranted, but not taken.

How can I learn more about the program before I sign up? The EPA and the Companies are producing a short video that demonstrates the equipment and techniques for home screening and for individual exposure evaluation. The video will be available to borrow (free of charge) from a number of locations throughout Southeast Idaho, including district health department offices (at 465 Memorial Drive in Pocatello and at 55 East First South in Soda Springs) and the libraries listed below, in addition to many local video rental stores. The video will answer many of your questions about the program. Please feel free to call the Phosphorus Slag Information Line (toll-free) at 1-888-905-8800 for more information, as well.

What can be done to reduce my exposure if I find slag on my property? The Graded Decision Guidelines identify a range of options (which the Companies have agreed to fund) for reducing exposure from slag. These options start with the easiest and least expensive, such as modifying the use of a room that contains slag, and range up to the most difficult and costly such as building an addition to the house. (See pages 4 and 5 of this fact sheet for more information about the Graded Decision Guidelines.)

The following libraries have materials related to the Phosphorus Slag program:

Pocatello Public Library
113 South Garfield
Pocatello, ID 83204
(208)232-1263

Soda Springs Public Library
149 South Main
Soda Springs, ID 83276
(208)547-2606

Idaho State University Library
Government Documents Department
9th and Terry
Pocatello, ID 83209
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Shoshone-Bannock Library
Pima and Bannock

Fort Hall, ID 83203
(208)238-3700 ext. 3882

Portneuf District Library
5210 Stuart Street
Chubbuck, ID 83202
(208)237-2192

What is the "inventory" and how will it be used?

The inventory is a listing or map of locations that have been tested and what the results were. Inclusion on the inventory is voluntary. The EPA Science Advisory Board (see "Background" on page 7 of this fact sheet) recommended that the EPA formally record the location of slag to assure that the radioactivity due to slag is adequately considered when disposing of materials as buildings are eventually replaced due to normal wear and tear. Information on the surveys of public areas will be included in the inventory automatically. Individuals may also elect to have test results for buildings they own (homes and businesses) included in the inventory.

Homeowners whose test results were negative (either at the time of the initial screening or after taking actions to reduce exposures) may be particularly interested in being included in the inventory.

Definitions

Surveys are performed with instruments that measure radiation directly and can identify specific locations in the home where radiation levels are highest. During the survey, you will be able to directly observe radiation levels in your home and around your property. Surveys measure the rate of radiation dose (for example, dose per hour) and in most cases can tell you whether your home has radiation levels above background, indicating that slag may be present in your home. Without extensive time spent measuring and modeling at various locations in your home, however, survey instruments cannot measure an individual's dose.

Background radiation varies by location and is a combination of cosmic radiation from space and radiation from naturally-occurring uranium, thorium, radium, radon, and potassium in the earth. The average background level for Soda Springs and Pocatello is approximately 105 mrems per year.

Thermoluminescent Dosimeters (TLDs) are small devices that measure radiation dose over time. They can be worn to measure radiation dose to a person wherever he or she goes, or they can be fixed in a place to measure the radiation dose at that location over a period of time. Normally, TLDs are used for a period of three months and then processed to determine the total dose accumulated during the period of exposure. TLDs are worn routinely by radiation workers and medical personnel to monitor their exposure. Use of TLDs alone will not tell you whether your home has radiation levels above background indicating the presence of slag may in your home. TLDs could help in determining whether you are currently receiving radiation in excess of background.

THE TESTING PROCESS**Graded Decision Guidelines**

The Graded Decision Guidelines recommended by the Technical Work Group (TWG) include various options that may be considered by property owners in responding to the results of the Exposure Study. The recommendations are based on three levels of exposure from phosphorus slag:

- For individual doses exceeding 500 mrems per year including background levels, it is recommended that actions be taken to reduce

radiation doses. All options, including construction of additional living space, should be considered to reduce exposures at this level;

- For individual **doses less than 100 mrem per year above background levels**, no further action is recommended; and
- For individual **doses between 100 mrem per year above background levels and 500 mrem per year including natural background levels**, it is recommended that a range of options be considered to reduce exposure. These potential options are described on the Options Menu pages 4 and 5 and start with the easiest and least expensive and range up to the most difficult and costly.

Copies of the Graded Decision Guidelines can be obtained by calling the Phosphorus Slag Information Line (toll-free) at 1-888-905-8800. Copies have also been placed at the libraries listed on page 2 of this fact sheet.

Issues Considered by the Technical Work Group during Development of its Guidelines

The TWG considered a variety of issues in developing its recommendations for the Graded Decision Guidelines, including risks, costs, and feasibility of various actions. The following is a summary of some of these issues.

Scientific opinion differs about how much low-level radiation an individual can be exposed to without harm. The possibility exists that there may be a threshold level of radiation exposure below which there are no adverse health effects. More is known about the effects of radiation than for most chemicals, however, and current evidence suggests that exposure to radiation at very low levels poses some risk of cancer. Instead of attempting to resolve these contentious questions, the TWG agreed to proceed using two assumptions:

1. The risk of cancer increases as exposure to radiation increases, and
2. Actions should be taken to reduce exposure only when they will result in more good than harm.

The TWG recommendations are therefore based on limiting exposure to radiation as much as practical while allowing homeowners the flexibility to make informed and educated decisions on actions they believe are necessary for their home and community.

OPTIONS MENU

In developing the guidelines, the TWG had little difficulty in establishing the point of no action (100 mrem per year above background) and the point at which all potential options should be considered (500 mrem per year inclusive of background). In the range between those two levels, however, it was more difficult for the TWG to reach consensus about how to balance risks and costs. There was general agreement that simpler and easier options would be more appropriate for lower doses (near 100 mrem per year) and more difficult options would be more appropriate at higher doses.

Many members of the TWG did not feel that this approach would provide sufficient guidance to individuals, however. As a result, the TWG developed a "menu" of possible options for specific dose levels. EPA didn't want individuals to feel restricted by the menu; the TWG members agreed that the options outlined in the menu were intended only as guidance. (It should be noted that the options are not mutually exclusive and several (or all) could be utilized, if necessary. The level of

financial assistance provided by the Companies may depend, however, on the exposure level (i.e., the most expensive options may not be funded by the Companies when there is only a low level of exposure.) The TWG did recommend that cost effective risk reduction options be considered on a case-by-case basis and that each homeowner should have the opportunity to discuss any specific concerns with a radiation risk professional and the Companies. The Companies have agreed to consider other options in good faith and to work to resolve disputes with individuals who may be dissatisfied.

Through its involvement in the TWG, EPA has tried to balance the potential risks from slag with such issues as costs and community acceptance. The TWG's recommendations are less conservative than EPA's usual approaches to environmental protection under most environmental laws. That is, the Graded Decision Guidelines call for less risk reduction than EPA would ordinarily find necessary. Under most laws and regulations, EPA is required to address risks from known or suspected carcinogens (chemicals associated with cancer) that increase the probability of developing cancer by more than 1 in 10,000 or 1 in 1,000,000 over a normal lifetime. By comparison, the 100 mrem per year screening level proposed by the TWG represents an increase in risk of approximately 3.5 in 1,000. EPA supports the TWG's recommendations for several reasons.

First of all, there are many differing viewpoints about what actions might be appropriate for dealing with slag. Second, there is a great deal of uncertainty about the actual risk associated with slag. Third, the Graded Decision Guidelines are **not** being employed in a regulatory context, but rather as part of a voluntary program. Fourth, they were developed with significant input from community representatives for the unique circumstances associated with previous slag use, particularly for individual residences. Fifth, they are not intended to be used in any other circumstance, including evaluation of future uses of slag. In conclusion, EPA supports the use of these guidelines as a way to move forward with the process of determining where risks exist and what might be done about them.

Excerpts from "The Phosphorus Slag Issue: Response to Public Comments"
Question: What happens if either I don't want to participate in the program or I only partially participate? Response: Nothing. The testing is entirely voluntary and an individual can decide not to participate at any time.
Question: How long will the testing program be offered? Response: Based on input received during the comment period, EPA and the Companies have agreed to conduct an initial phase of testing for approximately two years. After this initial period, the testing will be available for an indefinite period of time for those individuals that would like to participate. The extended offer will be particularly useful to either new residents or individuals that would like to have a residence re-tested.
Question: The focus of the exposure study seems to be the communities of Pocatello and Soda Springs. Can individuals outside these communities participate in the testing program? Response: Yes, individuals in surrounding communities are welcome to participate in the program.
Question: Who will pay for the testing program and implementation of the Graded Decision Guidelines? Response: FMC and Monsanto.
Question: How were the 20 rem per hour and 100 mrem per year screening levels established? Response: The 100 mrem per year level was selected primarily because it is a level at which it is practical to distinguish between exposures from natural background radiation and slag-influenced radiation. It is also consistent with the

"widely accepted population exposure guide of 100 mrem per year in excess of natural background" noted by the Science Advisory Board. Taking "occupancy factors" into account, the 20 rem per hour level was selected as a screening level below which it would be unlikely that anyone would actually receive 100 mrem in a year of normal occupancy.

Question: What level of radiation is safe?

Response: No one knows for sure.

Public Comment

Last fall, through a series of open houses and a fact sheet, EPA invited public comment on two documents, the "**Exposure Study Workplan**" and "**TWG s Recommendations for Graded Decision Guidelines**". The Exposure Study Workplan identified the equipment and techniques to be used to screen buildings for radiation and to measure individual exposure to radiation from slag. The TWG s Recommendations for Graded Decision Guidelines were developed to assist individuals in interpreting results from the exposure study.

EPA did not receive significant comments on either document. As a result, neither document was changed as a result of public comment and the voluntary program is about to begin according to the Exposure Study Workplan.

EPA has prepared detailed responses to the questions and comments received on the two documents during the public comment period. The responses are included in a document entitled "The Phosphorous Slag Issue: Response to Public Comments" which is available at the libraries on page 2 of this fact sheet.

EPA received many positive comments on the TWG s Recommendations. Many community members and local officials felt that the recommendations offered a reasonable approach for addressing the risk from phosphorus slag. There were some individuals that felt that the 100 mrem per year "no action" level was too high, however, and that the proposed risk reduction options would not adequately protect public health. These divergent opinions had been considered by the Technical Workgroup as they developed the Graded Decision Guidelines and are discussed in more detail on pages 4 and 5 of this fact sheet.

Background

In May 1990, the EPA issued a report called the **Idaho Radionuclide Study**. The study concluded that some citizens in Pocatello and Soda Springs could be at increased risk of developing cancer as a result of long-term exposure to low-level radiation from phosphorus slag used as a construction material in building foundations, streets, and sidewalks. (The slag is a by-product of the elemental phosphorus industry.) The EPA Science Advisory Board (SAB) reviewed the study and provided recommendations for further action that included additional testing of actual exposure to individuals and development of the Graded Decision Guidelines to help the public interpret testing results.

The SAB recommended that the Graded Decision Guidelines be based on technical and economic factors for both short-term and long-term exposure due to past uses of slag. The SAB also recommended that EPA make risk assessments for those persons exposed within the decision guidelines and provide them with information for making informed decisions. The SAB recommended that the information include: (a) the risks estimated for various exposures, (b) the associated uncertainties of estimating risks to individuals, (c) the options available to individuals under various programs to lower their risks, and (d) the costs of potential options to reduce exposures and who will pay for them.

In 1992 EPA, FMC, and Monsanto signed an agreement for implementing the SAB recommendations. This agreement included the creation of a TWG to assist EPA in

addressing technical and socioeconomic issues. The TWG was tasked to develop the Graded Decision Guidelines as there are no national standards that specifically address phosphorus slag. The TWG was composed of one Monsanto and one FMC representative; two EPA representatives; two company-selected and two EPA-selected radiation experts; and one representative each from the city of Pocatello, the city of Soda Springs, the State of Idaho, and the Shoshone Bannock Tribes. The TWG assisted EPA by preparing recommendations for guidelines to help the public interpret the testing results.

What About Radon?

The members of the TWG believe that risk from radon, although not associated with phosphorus slag, should be taken into consideration by homeowners when evaluating overall risk from radiation and risk reduction strategies. Accordingly, the proposed exposure study workplan includes free home testing for radon so that homeowners can factor the results into decisions on reducing overall radiation risks.

Radon can be found in all areas of the U.S. Occurrence is typically higher in areas with naturally occurring uranium in soil, such as in the Western U.S. Of the homes previously evaluated in Southeast Idaho, 14 exceeded EPA recommendations for radon.

Radon is an invisible, odorless gas and a natural part of the environment not manmade. Slag does not release significant quantities of radon. The costs to reduce radon in a home are generally low, and radon remediation is often effective in reducing risks from radiation. EPA has a national program to reduce public exposure to radon and recommends that all individuals test their homes and take action if levels associated with an increased lifetime cancer risk of approximately 1.3 in 100 are found. Radon remediation involves such things as sealing basement cracks, ventilating spaces with high radon levels, and installing sub-slab ventilation. A typical radon problem can be solved for \$1,000 to \$1,500.

For More Information:

If you have any questions about the contents of this fact sheet, please contact one of the following:

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Misha Vakoc, EPA Community Relations Coordinator, at (206) 553-8578

Tom Gesell, Technical Work Group Spokesperson, at (208) 236-3669

Michele Hall, Southeastern District Health Department, (208) 233-8800 or 1-888-905-8800

Trent Clark, Monsanto, at (208) 547-4300 (ext. 348)

Mike Smith, FMC, at (208) 343-4100

For those with impaired hearing or speech, please contact EPA's telecommunication device for the deaf (TDD) at (206) 553-1698.

To ensure effective communication with everyone, additional services can be made available to persons with disabilities by contacting one of the EPA staff above.

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The Exposure Study Workplan

EXECUTIVE SUMMARY

The Exposure Study will assess dose to individuals and as necessary the dose received at specific locations from exposure to radiation from elemental phosphorus slag, consistent with the provisions of the November 4, 1992, agreement between the U.S. Environmental Protection Agency (EPA), Monsanto Company, and FMC Corporation (the Companies).

The objectives of the Work Plan are:

1. Assess individual dose and identify sources of exposure.
2. Locate slag in the communities of Pocatello and Soda Springs.

The Work Plan includes the following project documents: a Project Management Plan (Appendix A), a Health and Safety Plan (Appendix B), a Quality Assurance Plan (Appendix C), Data Quality Objectives (Appendix D), and a Data Management Plan (Appendix E).

Individual dose results will be used for considerations in reducing exposure to radiation from slag based on the Graded Decision Guidelines.

Participation in the Exposure Study will be voluntary. Dose will be assessed after an initial exposure screening. Screening will be performed with dose rate meters unless the participant chooses to proceed directly to dose assessment. Dose assessment by dose rate meter and time of exposure or thermoluminescent dosimetry (TLD) will be available to the participants. Dose rate measurements will be used for identification and evaluation of sources of exposure for those receiving greater than or equal to 100 millirem per year (mrem/y) above background. Dose rate surveys of homes will require the permission of the homeowner and/or residents. Dose rate surveys of other locations will similarly require authorization by responsible authorities or individuals.

The Exposure Study results will be treated confidentially. Results will be provided directly to the individual or public official providing authorization (e.g., the homeowner and/or residents in the case of home surveys, public officials in the case of community surveys, etc.).

Generic dose information will be reported and published without identifying specific individuals or locations of individual exposure.

A report on locations of slag within the communities will be developed from previous investigations and this study so that local agencies can take necessary actions based on the radioactivity of materials when disposing of the materials. Residential, private, and public locations containing slag will be included in the report unless otherwise requested by the owner or proper authority.

1. STATEMENT OF WORK

The Exposure Study will assess dose to individuals and, as necessary, the dose

received at specific locations from exposure to radiation from elemental phosphorus slag, consistent with the provisions of the November 4, 1992, agreement between the U.S. Environmental Protection Agency (EPA), Monsanto Company, and FMC Corporation (the Companies).

The Exposure Study will assess above-background dose to individuals from exposure to gamma radiation from phosphorus slag. Participation in the Exposure Study will be voluntary. The Exposure Study will offer to identify and characterize, by means of dose rate measurements, slag sources potentially contributing an above-background dose greater than or equal to 100 mrem/y to the assessed individuals. The individual dose and dose rate data developed in the Exposure Study will be provided to participating individuals for use in the consideration of dose reduction activities.

Dose will be assessed after an initial exposure screening. Screening will be performed by dose rate unless the participant chooses to proceed directly to dose assessment. Dose assessment by dose rate meter and time of exposure or thermoluminescent dosimeter (TLD) will be available to the participants. A detailed dose rate assessment of locations possibly affecting the individual dose will be offered to all individuals found to have above-background doses greater than or equal to 100 mrem/y. Radon measurements will be offered for homes as part of dose assessment.

The Exposure Study will locate slag and report the location of slag in the communities of Pocatello and Soda Springs for purposes of disposal considerations. Slag will be located by information provided in the Idaho Radiation Study Aerial Survey and by additional dose rate measurements. The aerial data will be confirmed with dose rate measurements.

2. OBJECTIVES

2.1. ASSESS INDIVIDUAL DOSE AND IDENTIFY SOURCES OF EXPOSURE TLD or dose rate surveys will be offered to all individuals whose exposure screen indicates a possible above-background gamma dose from exposure to phosphorus slag. Dose assessment by dose rate meter and time of exposure or thermoluminescent dosimetry (TLD) will be available to the participants. When dose rate and time is employed to assess individual dose, every effort will be made to assess the dose with precision equal to TLD.

If a dose of less than 100 mrem/y above background is assessed, individuals will be notified and advised that no further assessment is recommended. Dose results of any value will be presented with reference to the Graded Decision Guidelines.

Individuals will be offered a dose-rate screening survey to determine the possibility of slag in their residences. The screening criterion for the indication that slag may be present is a dose rate of 20 microrem per hour (mrem/h) or greater as determined in the Methods Development Study (MDS) (see Table 2-1) (IT 1994). This screening will ensure that all possible exposure situations that could lead to doses of 100 mrem/y are investigated, since a dose rate in excess of 30 mrem/h is necessary for an above background annual dose of 100 mrem/y. Individuals who know that slag is in their residence or are reluctant to allow access for screening may elect to bypass the screen and proceed directly to dose assessment. Dose assessment will be offered by TLD or by dose rate and time log. Those who will not permit access for screening will have only the TLD choice for dose assessment.

2.2. LOCATE SLAG IN THE COMMUNITIES OF POCATELLO AND SODA SPRINGS A report on locations of slag within the communities will be developed from previous investigations and this study so that local agencies can take necessary actions based on the radioactivity of materials when disposing of the materials. Location of slag will be inferred from the aerial data from the Idaho Radionuclide Study (EPA 1990a). The locations that are greater than or equal to 20 mrem/h indicate the possibility of slag and will be recorded on street maps. The location of

slag will be confirmed during community dose rate surveys which include public buildings and facilities and specific source evaluations such as homes and private businesses. Inclusion of slag locations in a report will require permission by owner or proper authority.

3. METHODS AND MATERIALS

3.1. PARTICIPATION

The participation in the Exposure Study will be voluntary. Surveys of residences will require the permission of the owner or residents. Community surveys and surveys of public areas and facilities will require authorization of the appropriate public officials. Surveys of private businesses will require permission of the property owner.

Results will be provided directly to the individual or public official providing authorization (e.g., the owner in the case of residential surveys, public officials in the case of community surveys, etc.).

Generic dose information will be reported and published without identifying specific individuals or locations.

3.2. SCREENING CRITERIA AND SLAG IDENTIFICATION

The basic screening criteria are based on the Graded Decision Guideline of 100 mrem/y above background. For surveys performed with portable instruments, locations will be screened for dose rates greater than or equal to 20 mrem/h. A dose of 20 mrem/h indicates slag may be present. The source is presumed to be slag if it cannot be shown otherwise. Participants who know they have slag in their residences may elect to proceed directly to dose assessment by TLD.

The presence of slag may be verified by visual identification. Visual identification may be followed by mineralogical techniques such as determination of hardness, streak, and flaking characteristics. In some cases, the source of the elevated dose rate will not be directly accessible for visual and mineralogical techniques. In these cases, gamma spectral analysis may further indicate the presence of slag. It may be necessary to identify slag by aggressive sampling, such as coring or removal of the surface, when the slag is not directly accessible.

3.3. INDIVIDUAL DOSE ASSESSMENTS

Dose assessment by dose rate and duration of exposure or thermoluminescent dosimetry (TLD) will be available to the participants. TLDs were demonstrated in the MDS (see Table 2-1) to be the more precise method of dose assessment (IT 1994). The advantages and disadvantages of the two dose assessment techniques are given in Tables 3-1 and 3-2.

TABLE 3-1
ADVANTAGES AND DISADVANTAGES OF TLDs FOR MEASURING DOSE

Advantages	Disadvantages
1. Direct measure of dose	1. Three-month measurement time required before initial dose measurement result is available.
2. Has the potential to yield the most precise measure of dose.	2. Requires confirmation of presence of slag by mineralogical or other techniques.
3. Allows a large number of measurements to be performed in parallel.	3. Dosimeters can be lost or tampered with
4. Can indicate the possible presence of slag.	4. Individual dosimeters must be on or kept near the individual for the required 3-month measurement time.
5. Proven, widely used technique	5. Must establish TLD storage shield with a low, well known dose rate.
6. Less time intensive than dose rate-time log technique for dose estimation.	6. Several dosimeters may be needed to characterize dose at an individual's house.
7. Dosimeters are relatively unobtrusive and easy to deploy.	
8. Analytical result provided by vendor using standard analytical procedures.	

**TABLE 3-2
ADVANTAGES AND DISADVANTAGES OF DOSE RATE
INSTRUMENTS FOR MEASURING DOSE**

Advantages	Disadvantages
1. Portable, easy-to-use instruments can measure at a given location in a very short time, providing results without delay.	1. The measurements are performed serially from location to location rather than many performed in parallel.
2. Efficient method for location of sources of above-background radiation and for surveying large areas.	2. Requires information on time spending habits to estimate individual dose.
3. Can indicate the possible presence of slag.	3. Requires confirmation of presence of slag by mineralogical or other techniques.
4. No concern with tampering or loss.	4. Access to indoor house location(s) must be arranged.
5. Proven, widely used technique.	5. Surveys of living areas are time intensive
6. Technique is intrusive for study participants.	
7. Technique requires much data processing to estimate individual doses	
8. Instruments such as the PIC are inefficient to use at multiple locations.	

Descriptions of the measurement techniques and explanations of dose assessment will be provided to the public prior to the Exposure Study. These descriptions and explanations will be jointly developed by EPA and the Companies.

3.4. SPECIFIC SOURCE IDENTIFICATION AND EVALUATION

Individuals receiving greater than or equal to 100 mrem/y will be offered the option of a specific source identification and evaluation.

3.4.1. Detailed Surveys of Homes, Public Buildings, Facilities, and Private Businesses

If the dose assessment indicates doses greater than or equal to 100 mrem/y, a specific source evaluation will be offered to determine if there are reducible slag doses of greater than or equal to 100 mrem/y. However, more detailed time log information may be necessary. Those having reducible slag doses greater than or equal to 100 mrem/y will receive dose reduction evaluations under the Graded Decision Guidelines. Radon measurements will be offered for the residences of individuals greater than or equal to 100 mrem/y above background.

Locating the radiation from slag will be necessary for considering possible corrective actions. If radiation sources not associated with slag are present, they will also be noted as part of this survey. Information regarding time spent by individuals in each room within the house will be obtained as part of this survey.

Surveys will be performed by walkovers of rooms with hand-held rate meters during the detailed survey phase. Radiation gradients and nonuniformities will be noted as well as isolated sources of radiation from slag, or nearby sources of radiation from slag which may not be in the house. All measurements will be recorded on a sketch of the house floor plan.

3.5. LOCATING SLAG IN THE COMMUNITIES OF POCATELLO AND SODA SPRINGS

The Exposure Study will locate slag and report the location of slag in the communities of Pocatello and Soda Springs for purposes of disposal considerations. Identification shall be as slag-containing gravel, asphalt, or concrete. Location of slag will be inferred from the aerial data from the Idaho Radionuclide Study (EPA 1990a). Locations that are greater than or equal to 20 mrem/h indicate the possibility of slag and will be recorded on street maps. The location of slag will be confirmed in community surveys and specific source evaluations. Other areas found to have slag during the community surveys will be added to the maps. Residential, private, and public locations containing slag, as identified by activities described in Sections 3.3 and 3.4, will be included on the maps if requested by the owner or proper authority.

3.6. EQUIPMENT AND PROCEDURES

Radiation measurement equipment will include Bicron :rem meters,

pressurized ionization chambers (PIC), a sodium iodide spectrometer, and TLDs. Procedures for use and calibration of equipment and devices shall be as described in or developed from results of the MDS (see Table 2-1) (IT 1994).

3.7. BACKGROUND REFERENCE DOSE RATES

Background dose rates will be determined at background locations as determined for the MDS. Background and background distribution were reported in the MDS which included a discussion on measuring the difference from background. For detailed surveys and identification of sources, background will be verified by local measurements. Slag will be assumed to influence the dose rate if slag is found within 10 meters (approximately 30 feet) of the location.

TLD. At least ten background locations will be established for placing pairs of background control TLDs. TLDs will remain deployed for approximately 90 days, at which time they will be replaced by 20 more TLDs; the collected TLDs will be sent for analysis. This process will continue for the duration of the Exposure Study. The dose rate result from each set of TLDs will be compared to the exposure rate measured at that location with a PIC. Exposure Rate. The standard for exposure rate will be the PIC. All measurements of dose rate in the Exposure Study, except PIC quality assurance (QA) measurements, will be performed with the mrem meter. The mrem meter QA measurements will be taken at the same time as PIC QA measurements and the results compared. The PIC measurements at the background TLD locations will constitute the reference exposure rates for comparison to the mean background and distribution.

3.8. WORK PRODUCTS

The Exposure Study work products shall be:


1. Reports of individual dose and any subsequent specific source surveys
2. Community survey for Pocatello and Soda Springs including maps showing locations of slag in the community
3. Survey results for public areas and facilities and private businesses.

3.9. DATA QUALITY

Data quality and data validation require that the factors of precision, accuracy, completeness, representativeness, and comparability be addressed (see Appendix D). Data quality also includes consideration of the statistical power of a test based on the data and ensuring that the relative uncertainty of the data is as low as possible. The MDS (see Table 2-1) determined the detection limits of various exposure measurement techniques. The practical limit for distinguishing a difference from background was found to be approximately 30 mrem/y.

3.10. VALIDATING STATISTICAL SIGNIFICANCE OF DATA SETS

Data obtained will be compared to the mean background and



background distribution. Data will be considered different from background based on the Currie critical level. Local backgrounds will be established. The establishment of the 20 mrem/h screening level and the annual dose level of 100 mrem/y as criteria ensures that data affecting decisions are well known statistically since these values are well above the Currie critical level. See discussion concerning detection limits in Appendix D.

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GRADED DECISION GUIDELINES FOR PHOSPHORUS SLAG

Guidance for Individuals to Use in Determining Appropriate Actions to Reduce Radiation Exposure Due to Phosphorus Slag

As recommended to the U.S. Environmental Protection Agency by the Southeast Idaho Technical Work Group on Slag

I. Introduction

What is slag?

Elemental phosphorus slag is a byproduct of elemental phosphorus. The slag contains natural radioactive material at levels higher than found in most ordinary rock and soil. This radioactive material emits gamma radiation which is a type of radiation similar to medical x-rays. Phosphorus slag has been used in residential construction, streets, sidewalks, and construction fill in Pocatello, Soda Springs, and nearby areas of southeastern Idaho, including Caribou, Bannock, and Power Counties.

What prompted concern about slag?

The EPA performed a study of the potential radiation doses from slag received by residents in southeastern Idaho. One of the conclusions was that some citizens in Pocatello and Soda Springs could be at elevated risk of getting cancer due to long term exposure to slag. The EPA Science Advisory Board reviewed the report of the study following its release in 1990 and made recommendations which included:

- conducting further tests to determine actual radiation exposure to individuals;
- establishing a set of "graded decision guidelines" to help individuals interpret their exposure results and determine what, if any, actions should be taken to reduce that exposure. These guidelines will be based upon technical and economic factors for both short-term and long-term public exposure due to past uses of slag. The Science Advisory Board also recommended that the guidelines be made available for public review.
- working with local and state officials, the public and industry to make measurements for individuals based on their particular exposure conditions.

How were these concerns to be addressed?

To address these recommendations, a Technical Work Group was created in November of 1992. The Technical Work Group includes representatives from:

- EPA,
- the State of Idaho,

- FMC,
- Monsanto,
- the Shoshone-Bannock Tribes,
- the Agency for Toxic Substances and Disease Registry, and the communities of
- Soda Springs and
- Pocatello.

The Technical Work Group was created to assist EPA and the companies in the design of the Methods Development Study and to assist EPA in implementation of the exposure studies and the development of graded decision guidelines.

This document is the Technical Work Group's recommendations to EPA for graded decision guidelines. This version includes changes and recommendations made at the June 1, 1995, Technical Work Group meeting.

II. Radiation terms and perspective

How much radiation occurs "naturally?"

Dose from various sources of radiation can be expressed in terms of a single quantity, millirem, which is abbreviated mrem. If all ordinary sources of radiation dose are included, such as from natural gamma rays, cosmic rays, radon, medical procedures, consumer products and miscellaneous sources, the U.S. national average dose is about 360 mrem per year. Annual doses received by specific individuals can vary considerably from this average value. The average dose from sources except slag in Pocatello and Soda springs is expected to be about 400 mrem per year because levels of natural radiation are higher than the national average. The natural background in the Soda Springs and Pocatello areas from natural gamma rays and cosmic rays alone, while average about 100 mrem per year.

What is the risk from radiation?

Dose from slag radiation is in addition to these amounts. For radiation protection purposes, risk is usually assumed to be proportional to dose. According to the International Commission on Radiological Protection, 100 mrem would have an associated potential risk of fatal cancer of five in one hundred thousand. Table II-1 lists examples of radiation exposures, standards and recommendations.

Table II-1. Examples of radiation exposures, standards and recommendations

Exposure Condition	Annual Dose (mrem)
Radiation worker limit	5,000
Radon daughter limit for uranium miners	4,000
Indoor radon level for which action is recommended by EPA (United States Environmental Protection Agency) (4 pCi/L)	1,000
Lowest radon level for which EPA (United States Environmental Protection Agency) recommends that homeowners consider remedial action (2pCi/L)	500
NCRP (National Council on Radiation Protection and Measurements) remedial action threshold (including background)	500
NCRP (National Council on Radiation Protection and Measurements) recommended limit for infrequent exposure of the public from facilities that emit radiation or radioactivity	500
Average dose to U.S. citizen from all sources	360
Average radon exposure (0.8 pCi/L)	200
Gamma radiation limit for buildings contaminated with uranium mill tailings (above background)	175
Typical dose to civilian air crews	160
NCRP (National Council on Radiation Protection and Measurements) recommended limit for continuous or frequent exposure of the public from facilities that emit radiation or radioactivity	100
U.S. average natural background except radon	100
U.S. average for diagnostic radiological medical procedures	53
One transcontinental round trip per year by air	5

III. Summary of the graded decision guidelines

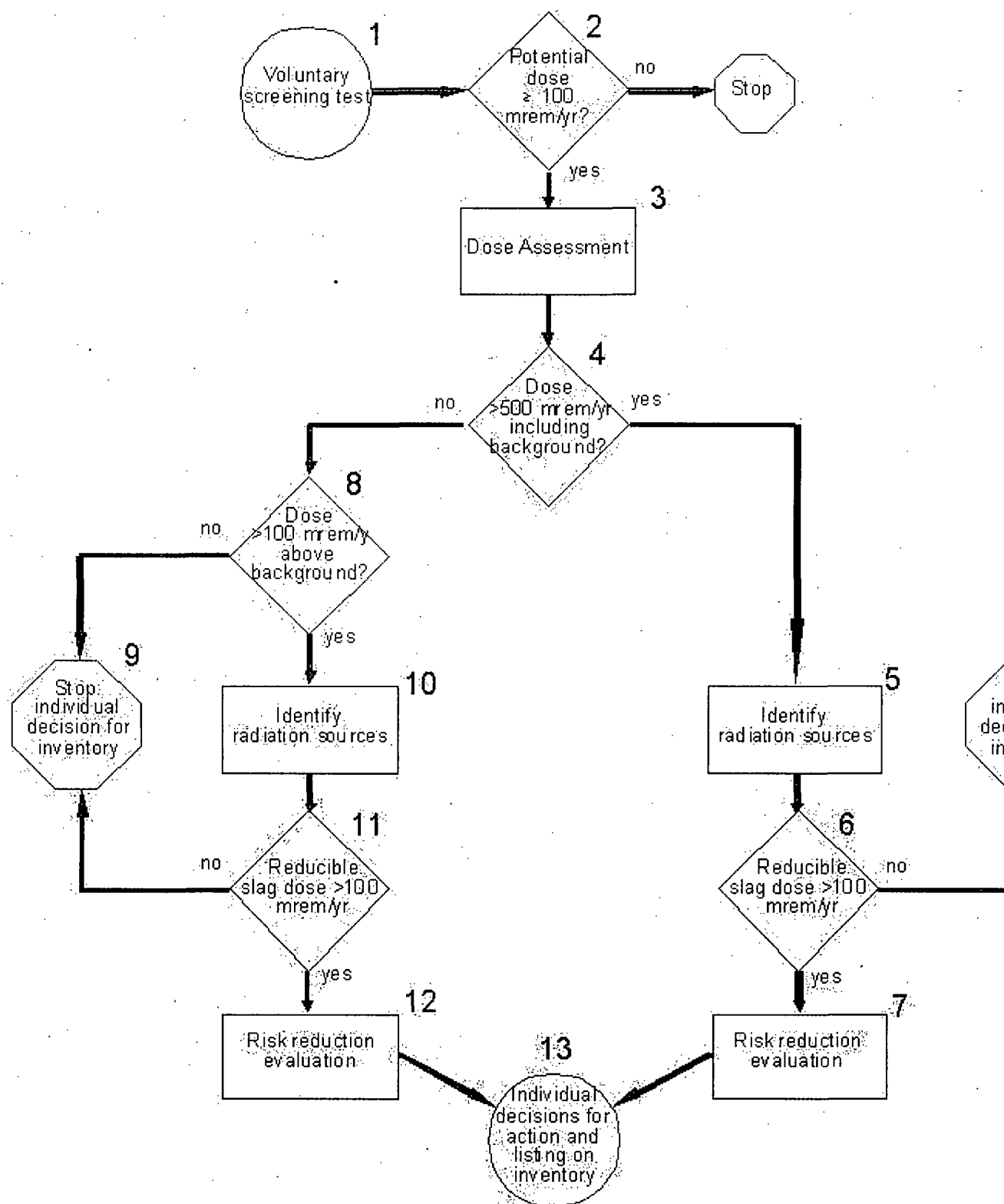
What guidelines can be used for making decisions about slag?

The graded decision guidelines may be summarized briefly as follows:

1. For individual doses which exceed 500 mrem per year including natural background, action is recommended if a reduction of at least 100 mrem per year from slag can be achieved. A list of actions to reduce exposure is available.
2. For individual doses less than 100 mrem per year above background, no action is recommended.
3. For individual doses between 100 mrem above background and 500 mrem including background, it is recommended that actions be considered to reduce exposure if a reduction of at least 100 mrem per year from slag can be achieved. A menu of options to reduce exposure is available.

The graded decision guideline process is given in more detail below. A flow chart illustrates the process and each "box" in the chart is described in a numbered list corresponding to the numbers on the flow chart (section IV). The recommended processes for collecting data to support the graded decision guidelines are included and discussed briefly for clarity where appropriate. A list of options for risk reduction actions is keyed to dose levels in section V. Finally, radon as a source of radiation exposure in dwellings is discussed

in Section VI.



IV. Notes on the graded decision guideline flow chart

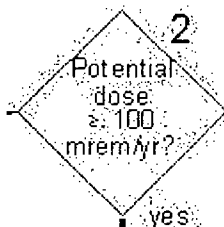
The numbers below correspond to the numbered blocks on the flow chart:



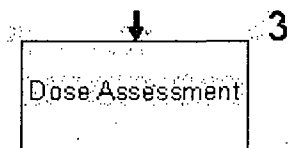
1 Residents in the designated areas will be offered an opportunity to participate in a screen test for elevated exposure rate.

1.1 Residents will be offered screening with a portable survey instrument (meter). If accepted, the dwelling will be surveyed with a sensitive meter capable of measuring in the $\mu\text{R/h}$ range. As a practical matter, if the exposure rate is less than $20 \mu\text{R/h}$, it will be assumed that there is no potential for residents to equal or exceed 100 mrem per year above background.

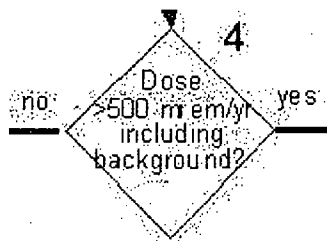
1.2 If the residents wish to enter the process but do not wish to allow technicians into their homes to perform screening with a meter, a dose assessment with TLD will be offered (item 3).



2 If the exposure rate in and around the dwelling does not have the potential to cause individual dose to equal or exceed 100 mrem per year above background, or if the residents decline a dose assessment, the process stops. If the exposure rate in and around the dwelling has the potential to cause residents to equal or exceed 100 mrem per year above background, a dose assessment will be offered (item 3).



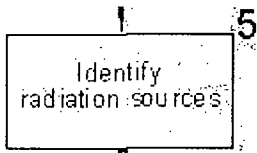
3 A dose assessment is different from a screening test in that actual dose to the residents of the dwelling is assessed rather than the exposure rate in the dwelling. Options available for dose assessment will include TLDs and survey meters.



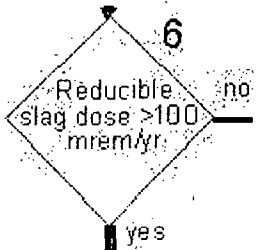
4 If the assessed dose exceeds 500 mrem per year, including natural background from external sources, a survey to identify radiation sources will be offered.

4.1 If the resident accepts, the survey to identify radiation sources will be performed (item 5)

4.2 If the resident declines the survey to identify radiation sources, the process stops. If the property owner wishes the property to be listed on an inventory, this will be done (item 9).



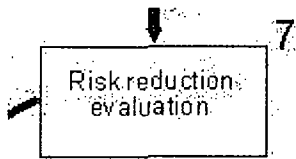
5 A survey to identify radiation sources is performed in an effort to determine the type and magnitude of the sources leading to the dose exceeding 500 mrem including background. Various techniques are available including exposure rate measurement, visual and chemical identification of slag and gamma-ray spectroscopy. These methods are detailed in the Exposure Study Work Plan.



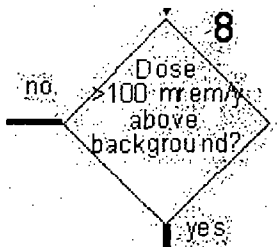
6 Based upon item 5 above, reducible slag dose is determined. Reducible slag dose comes from slag in dwellings. Examples of sources of dose that would not be considered reducible slag dose are dose from non-slag radioactive building materials in dwellings and dose received occupationally from slag.

6.1 If the survey to identify radiation sources indicates that reducible slag dose equals or exceeds 100 mrem per year, action is recommended (item 7).

6.2 If the reducible slag dose does not equal or exceed 100 mrem, the process stops. If the property owner wishes the property to be listed on an inventory, this will be done (item 9).



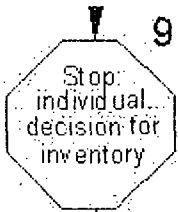
7 A list of possible actions for doses above 500 mrem including background is described in section V. C. of this document.



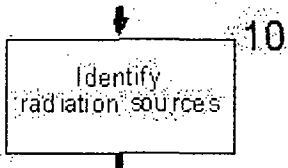
8 If the assessed dose is less than 100 mrem per year above background, the process stops. If the property owner wishes the property to be listed on an inventory, this will be done (item 9). If the dose exceeds 100 mrem per year above background, then a survey to identify radiation sources will be offered (item 10).

8.1 If the resident accepts, the survey to identify radiation sources will be performed (item 10).

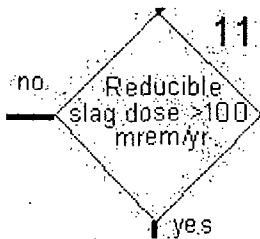
8.2 If the resident declines a survey to identify radiation sources, the process stops. If the property owner wishes the property to be listed on an inventory, this will be done (item 9).



9 Whenever a structure that contains slag is eliminated from further consideration for action, or slag remains after action is taken, listing of the structure on the slag inventory is offered to the owner. The permission of the owner (for private property) or the responsible public official (for public property) is required prior to listing.



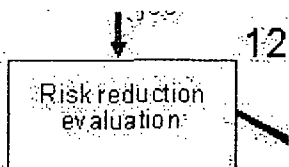
10 A Survey to identify radiation sources is performed in an effort to determine the type and magnitude of the sources leading to the dose exceeding 100 mrem above background. Various techniques are available including exposure rate measurement, visual and chemical identification of slag and gamma-ray spectroscopy. These methods are detailed in the Exposure Study Work Plan.



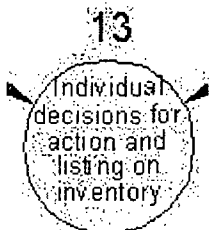
11 Based upon item 10 above, reducible slag dose is determined.

11.1 If the survey to identify radiation sources indicates the reducible dose due to slag equals or exceeds 100 mrem per year, risk reduction evaluation is offered (item 12).

11.2 If the reducible slag dose does not equal or exceed 100 mrem, the process stops. If the property owner wishes the property to be listed on an inventory, this will be done (item 9).



12 A "menu" of possible risk reduction options for doses in the range of 100 mrem per year above background to 500 mrem per year including background is available and is described in Section V. B. of this document.



13 The affected individual makes the final decision on action to be taken. If slag remains after action is taken, permission of the owner (for private property) or the responsible public official (for public property) would be required prior to listing on the inventory.

V. Menu of options for risk reduction actions

A. General Options

It is recommended that actions be considered to reduce exposure if a reduction of at least 100 mrem per year from slag can be achieved. The potential options identified for risk reduction actions are as follows:

- Education, counseling, and attrition
- Use modification
- Remodeling, shielding, and/or partial removal
- Additional living space

These options are defined in section D below. Some options are more difficult, time consuming, and costly than others. The options listed start with the easiest and least expensive and range up to the most difficult and costly. In general, simpler and easier options would be more appropriate for lower doses (near 100 mrem above background). More difficult options would be more appropriate at higher doses. The options on the risk reduction "menu" are not mutually exclusive and several or all could be utilized if needed. Other actions may be possible.

B. Menu for 100 mrem per year above background to 500 mrem per year including background

Since decisions regarding actions will be up to the individual and will involve specific and detailed evaluation of the home, the Technical Work Group considered whether the ranking of options within a "menu" provided sufficient guidance to individuals. The Work Group also considered whether sufficient data were available to provide a basis for recommending that particular options from a "menu" be associated with specific dose levels. A majority of the Work Group agreed that some additional detail was needed to show dose levels for which the various options could apply. These dose levels are intended as recommended guidance which is likely to be appropriate in most cases.

The following guidelines for risk reduction recommendations are intended to be general guidelines that are appropriate for the majority of people who are considering options to reduce their dose due to slag. These guidelines are not intended to restrict individual choice in reducing risk, but it should be understood that funds may not be available to address options outside these guidelines.

Cost effective risk reduction options should be considered on a case-by-case basis and each homeowner should have an opportunity to discuss their specific concerns with a radiation risk professional.

In the range from 100 mrem above background to 500 mrem including background, the guidance in the following menu is recommended by the Technical Work Group to aid individuals in selecting options if a reduction of at least 100 mrem per year from slag can be achieved.

Table V-1. Menu: Summary of guidelines for risk reduction actions for the range 100 mrem per year to 500 mrem per year including background.

Dose range (mrem per year)	Action
More than 100 above background	Education, counseling, and attrition
More than 200 above background	Above actions plus: use modification
More than 300 above background up to 500 including background	Above actions plus: remodeling, shielding, and/or partial removal

C. Options for greater than 500 mrem per year including background

For doses greater than 500 mrem per year including background, the Technical Work Group recommends that all options from the menu plus "additional living space" be considered for risk reduction if a reduction of at least 100 mrem per year from slag can be achieved. The options for greater than 500 mrem per year including background are not mutually exclusive and several could be utilized.

D. Explanations of action terms

1. Education / Counseling

Applicable dose range: more than 100 mrem above background

Education and counseling would include a balanced discussion of radiation risk and radiation protective measures. Commonly asked questions would be anticipated and answered. This would include exploring the range of possible actions that could be taken to reduce an individual's dose such as possible changes in use patterns (for example, spend less time in basement by moving primary living areas from basement to upper floors)

2. Attrition

Applicable dose range: more than 100 mrem above background

Attrition means removing slag once a structure's useful life has ended. Attrition includes 1) listing the location of the slag that triggered a dose over a Graded Decision Guideline level, 2) tracking the disposition of the material, and 3) eventually managing the disposal of the material. For example, once a structure has been listed on the inventory and is scheduled for demolition, the slag matrix would be picked up and removed to a disposal location. If an owner agreed to attrition, the owner would be automatically agreeing to the listing, tracking and disposal process.

3. Use modification

Applicable dose range: more than 200 mrem above background

Use modification refers to actively facilitating changes in home use that would reduce the amount of time that individuals spend in a space where slag significantly contributes to individual dose. An example is converting a basement bedroom to an alternative use for which individuals spend less time in the room.

4. Remodeling / shielding / partial removal

Applicable dose range: more than 300 mrem above background

Remodeling includes altering the design of a room to replace an existing slag-containing space that contributes significantly to individual dose. Or it may be feasible to remove the slag only in the area of elevated exposure rate. For example the shielding or removal of one wall in a high exposure rate area may reduce most of the individual dose in that particular area.

5. Additional living space

Applicable dose range: more than 500 mrem including background

This option would provide additional living space to eliminate current home use patterns that contribute to an elevated individual dose. For example building a new bedroom or other addition to replace a basement bedroom would reduce dose.

VI. Radon

What is radon?

Although not associated with slag or gamma radiation, indoor radon is an important contributor to radiation dose received in dwellings (Table II-1). For this reason it is recommended that radon measurements be offered to residents for whom surveys to identify radiation sources are performed (items 5 and 10 in section IV).

What should be done about it?

If the radon concentration exceeds the EPA action level of four picocuries per liter of air, radon reduction should be recommended to residents. EPA further recommends that if a level of two picocuries per liter of air is exceeded, residents should consider radon reduction. Radon reduction includes a graded series of actions such as sealing basement cracks, ventilating spaces with high radon levels, and installing sub-slab ventilation to reduce soil gas pressure under the foundation.

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The Phosphorus Slag Issue: Response to Public Comments

U.S. Environmental Protection Agency (EPA) response to comments received during the 30 day public comment period (September 18 to October 17, 1995) on the "Exposure Study Workplan" and Technical Work Group recommendations for "Graded Decision Guidelines".

EPA Response to Comments and Questions Received During Public Comment Period

Comment: How did the Technical Work Group (TWG) reach agreement on Graded Decision Guidelines given the different interests the members represented?

Response: The Technical Work Group attempted, where possible, to make recommendations based on consensus. Since the TWG reflected a wide range of perspectives the TWG products represent as much common ground as could be found.

The TWG agreed on a "graded" set of guidelines incorporating a middle range of radiation exposure levels between the recommendation for action and the recommendation for no action. In this middle range the specific circumstances and concerns of the homeowner are the primary determining factors in deciding what actions are acceptable.

Comment: What level of radiation is safe?

Response: No one knows for sure. EPA's position is that it is reasonable to assume, for radiation protection purposes, that there is no level of radiation which can be determined to be harmless to people. This position takes into account the best available evidence and the uncertainties involved. The purpose of the TWG efforts was not to resolve whether there are risks associated with slag. The purpose was to develop guidelines for what, if any, actions might be acceptable to address the risks from slag.

There is general agreement that exposure to slag causes some additional radiation exposure. Since EPA believes even small amounts of radiation carry some small risk, it also believes that there are some risks associated with exposure to slag. However, the fact that there is some risk does not necessarily mean action (such as slag removal) is always warranted in every case. EPA's goal in other radiation control contexts is an "acceptable" level of risk which also takes into consideration the practicality of actions to reduce radiation exposure.

Comment: Who will pay for the testing program and implementation of the Graded Decision Guidelines?

Response: FMC and Monsanto. These two Companies will soon sign an agreement with EPA for conducting the exposure study and taking actions to reduce individual exposures from phosphorus slag within the framework of the Graded Decision Guidelines. The Companies will also reimburse EPA and the District Health Department for their expenses during the program.

Comment: How were the 20 microrem/hr and 100 millirem/yr screening levels established?

Response: The 100 millirem/year level was selected primarily because it is a level at which it

is practical to distinguish between exposures from natural background radiation and slag-influenced radiation. It is also consistent with the "widely accepted population exposure guide of 100 millirems per year in excess of natural background" noted by the Science Advisory Board (SAB) in their review of the Idaho radionuclide Study.

Radiation levels of 20 microrem/hour above background will, over the course of a year (24 hours per day, 365 days per year) result in a cumulative radiation exposure of 175 millirem for that year. It is unlikely, however, that anyone would actually remain in any one location for 8766 hours in a year. Taking "occupancy factors" into account, the 20 microrem/hour level was selected as a screening level below which it would be unlikely that anyone would actually receive 100 millirem in a year of normal occupancy.

Comment: The focus of the exposure study seems to be the communities of Pocatello, and Soda Springs. Can individuals outside these communities participate in the testing program?

Response: Yes. Individuals in surrounding communities are welcome to participate in the program.

The focus of the TWG discussions and EPA's efforts on this issue have been on Pocatello and Soda Springs, since slag was known to have been used as a construction material for some homes in these communities. Based on previous studies exposures in a home constructed with slag may be in the range of the Graded Decision Guidelines. It is possible that there are homes or businesses outside of these two communities where slag may have been used. Therefore, the program is open to anyone that has concerns regarding possible exposure to radiation from phosphorus slag.

Comment: What do individuals need to do to have their place of employment tested?

Response: Surveys will not be performed in any location without authorization from the person responsible for the location (e.g. homeowner, building manager, business owner, etc.) If you wish to have your workplace included in the testing you should contact your employer or landlord.

Comment: What are the long-term health effects from phosphorus slag?

Response: No one really knows. Slag contains natural radioactive material at levels higher than found in most ordinary rock and soil. This radioactive material emits gamma radiation which is a type of radiation similar to medical X-rays. The primary health effect associated with gamma radiation is cancer. It is not known whether the low levels of gamma radiation associated with slag can cause cancer. Compounding this uncertainty is the fact that there may be a hundredfold difference among individuals in the way they respond to a carcinogen, such as radiation.

In the face of this kind of uncertainty scientists use risk estimates to determine what levels of exposure to a carcinogen are acceptable. For radiation protection purposes, risk estimates assume that even small amounts of radiation pose some risk. At exposures comparable to external background radiation, however, the possibility that there may be no risks cannot be ruled out.

For communities close to uranium mines where low level radiation exists, EPA recommends action when risks are increased by at least one in 10,000 over existing cancer risks. Using EPA risk assessment guidelines for radiation a 100 millirem/yr exposure represents a 30 in 10,000 excess lifetime risk of cancer. Based on previous studies an exposure of 205 millirem/yr may be possible from slag, which is equivalent to approximately a 60 in 10,000 excess lifetime risk of cancer. These risks represent small fractions of the "everyday" risk of cancer, which is approximately 2,500 in 10,000.

Comment: How much has been spent by EPA and the Companies on this issue since it was first identified as compared to the public health benefit.

Response: The EPA does not have information on how much the Companies have spent to

address this issue. Since 1980 EPA has spent approximately \$586,000 on the phosphate slag issue. The costs for the Idaho Radionuclide Study was approximately \$700,000. These costs are associated with staff time, overhead, travel expenses, and technical support. The Companies reimburse EPA for it's expenses on this project.

Actions taken to reduce exposure, as outlined in the Graded Decision Guidelines, will reduce the risk of cancer. As yet no public-health benefits have been realized since no exposure reduction measures have been implemented.

The costs to reduce risks from developing cancer vary considerably in this country depending on a variety of factors such as who bears the risk, who derives the benefit, who bears the costs, and whether it is a voluntary or involuntary risk. In a recent uranium mill tailings cleanup in Monticello, Utah, where low levels of radiation exist, \$5.6 Million was spent by the Department of Energy on 101 homes to reduce radiation exposures by an estimated 119 mrem/yr.

Comment: Why was it necessary to develop Graded Decision Guidelines? Isn't there a national standard that applies to radiation exposure from phosphorus slag.

Response: There are no national standards that apply specifically to radiation exposure from phosphorus slag.

In developing the Graded Decision Guidelines, the Technical Workgroup considered a wide variety of standards and guidance for radiation protection:

- Existing standards for other types of naturally occurring radioactive material (including EPA Standards for Remedial Actions at Inactive Uranium Processing Sites, 40 CFR 192),
- Other existing radiation protection regulations (including Environmental Radiation Protection Standards for Nuclear Power Operations, 40 CFR 190 and National Emission Standards for Hazardous Air Pollutants - Radionuclides, 40 CFR 61),
- Proposed standards for radiation exposure (including EPA Federal Radiation Protection Guidance for Exposure of the General Public, December 23, 1994),
- Guidelines from national and international radiation advisory bodies (including the International Commission on Radiation Protection and the National Council on Radiation Protection and Measurements), and standards which were in the process of development (including EPA's Draft Radiation Site Cleanup Rule).

Comment: Did the TWG make any decisions on potential future uses of slag?

Response: No. The Graded Decision Guidelines do not address the future use of slag, since future use of slag was not part of the charter of the TWG. The Companies no longer sell or distribute phosphate slag and have agreed to not use the material outside of their operating areas, without EPA approval. Based on current knowledge of radiation risks associated with slag EPA does not recommend use of this material for any purpose. EPA believes that the potential health benefits derived from restricting use of slag far outweigh any "benefits" from continued use.

Comment: Will all public buildings be included in the testing program?

Response: Not automatically, surveys will not be performed without authorization from the person responsible for the location. EPA encourages all local officials to request that the public areas they are responsible for be included in the program, and make the results available to the public.

Comment: Will this program affect my property value?

Response: It shouldn't, given the confidential nature of this program. If the results indicate that action be considered to reduce exposure then you will have an opportunity to reduce that exposure using the Graded Decision Guidelines and Company support. Any actions taken to

reduce an exposure may be useful information to any prospective buyer. In some situations actions may enhance the value of your property.

Comment: Clarify the relationship between EPA, the Companies, and IT Corporation on this issue.

Response: EPA has signed an agreement with FMC and Monsanto to conduct the exposure study and implement the graded decision guidelines. IT Corporation was employed by the Companies to provide technical support. IT has now been replaced by Auxier and Associates of Knoxville, TN.

Comment: How long will the testing program be offered?

Response: EPA received many comments on the length of time the testing program should be offered ranging from a limited time offering to indefinite. Based on this input EPA and the Companies have agreed to conduct an initial phase of testing for approximately two years. During the initial phase there will be active promotion of the program to get as many homes screened as possible and complete an inventory of all public areas. After this initial phase the testing will be available for an indefinite period of time for those individuals that would like to participate. The extended offer will be particularly useful to either new residents or individuals that would like to have a residence re-tested.

Comment: Will my testing results be confidential?

Response: Yes. The results of any testing will be maintained as confidential by the contractor working for the Companies and the District Health Department. Testing results will be reported to EPA and the public in aggregate only (no names and addresses will be used). For example, we might occasionally provide statistics on how many properties have been tested and what the range of results were.

Comment: What happens if either I don't participate in the program or only partially participate?

Response: Nothing! The testing is entirely voluntary and an individual can decide not to participate at any time.

Comment: Can radiation from phosphorus slag have any impact on anything else in my house, such as stored foods in a basement?

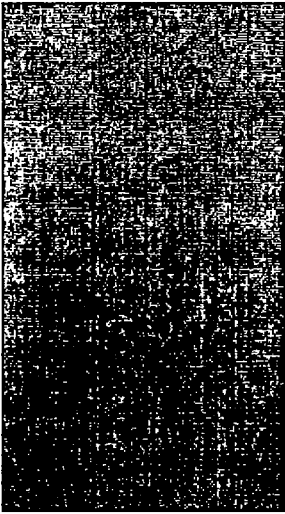
Response: No. Radiation levels from phosphorus slag are low enough to not have any direct or measurable impacts on anything else in the home.

Comment: What is the "Inventory" and how will it be used?

Response: The inventory is a listing or map of locations that have been tested and what the results were.

The SAB recommended that EPA formally record the location of slag to assure that the radioactivity due to slag content is adequately considered when disposing of the materials when these areas are eventually replaced (due to normal wear and tear). Information on the surveys of public areas will be part of the inventory. Individuals may also elect to have their home test results included on the inventory. This may be particularly true for homeowners whose test results were negative either at the time of initial screening or after taking actions to reduce exposures, or for those that have elected the "attrition" option.

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9. [How does Radiation Affect Human Health?](#)
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Documents Related to this Program

1. [Fact Sheet Distributed to Area Residents in September 1995](#)
2. [Hand Outs Provided at Public Meetings Held in September 1995](#)
3. [Fact Sheet Distributed to Area Residents in May 1996](#)
4. [The Exposure Study Workplan](#)
5. [The Graded Decision Guidelines](#)
6. [The Phosphorus Slag Issue: Response to Public Comments](#)
7. [The Memorandum of Agreement Between the Southeastern Idaho District Health Department and the Companies \(FMC Corporation and Monsanto Company\)](#)
8. [The Administrative Order On Consent](#)

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